BHL

BRITISH MUSEUM (NATURAL HISTORY).

BRITISH ANTARCTIC ("TERRA NOVA") EXPEDITION, 1910.

NATURAL HISTORY REPORTS.

ZOOLOGY. VOL. VI.

PROTOZOA.
PORIFERA.

LONDON:
PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM.
Sold by B. Quaritch, Ltd., 11, Grafton Street, New Bond Street, London, W.1;
Dulau & Co., Ltd., 2, Stafford Street, London, W.1;
Oxford University Press, Warwick Square, London, E.C.4;
and at the
British Museum (Natural History), Cromwell Road, London, S.W.7.
1921–1929.
[*All rights reserved.*]

CONTENTS.

1. WOODCOCK, H. M., and LODGE, OLIVE. Protozoa. Part I.—Parasitic Protozoa.
[*Issued January* 22, 1921.]
Pp. 1–24, 3 pls.

2. HERON-ALLEN, E., and EARLAND, A. Protozoa. Part II.—Foraminifera.
[*Issued March* 25, 1922.]
Pp. 25–268, 8 pls.

3. DENDY, ARTHUR. Porifera. Part I.—Non-Antarctic Sponges.
[*Issued March* 22, 1924.]
Pp. 269–392, 15 pls.

4. BURTON, MAURICE. Porifera. Part II.—Antarctic Sponges.
[*Issued April* 27, 1929.]
Pp. 393–458, 5 pls.

BRITISH MUSEUM (NATURAL HISTORY)

BRITISH ANTARCTIC ("TERRA NOVA") EXPEDITION, 1910.

NATURAL HISTORY REPORT.

ZOOLOGY. VOL. VI, No. 1. Pp. 1–24.

PROTOZOA.

PART I. PARASITIC PROTOZOA.

BY

H. M. WOODCOCK, D.S.

AND

OLIVE LODGE

WITH TEXT FIGURES IN THE TEXT AND FOUR PLATES.

LONDON:
PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM.
1911.

Price Nine Shillings.

British Museum (Natural History).

"Terra Nova" Report.

This is No. 3. *of* 25 *copies of Zoology, Vol. VI., No.* 1, *Protozoa, Part I., printed on Special paper.*

22 MAR 1921

BRITISH MUSEUM
Z D
NATURAL HISTORY

PROTOZOA.

PART I.—PARASITIC PROTOZOA.*

BY H. M. WOODCOCK, D.Sc., AND OLIVE LODGE.

WITH ONE FIGURE IN THE TEXT AND THREE PLATES.

CONTENTS.

	PAGE
Introduction	1
Flagellata	2
Gregarinidea	5
Ciliata	7
Index	23

INTRODUCTION.

The Collection of Parasitic Protozoa, which was made by Surgeon-Commander E. L. Atkinson and Mr. D. G. Lillie, has proved somewhat disappointing, if regarded from the standpoint of its furnishing any indication as to the occurrence and importance of these parasites among the fauna of the Antarctic regions. The material handed to us has yielded only three forms: a Flagellate, a Gregarine, and a Ciliate. There are references in Surgeon-Commander Atkinson's notes to one or two instances of fish suspected to have been infected with cysts of a Myxosporidian; but we can only say that our examination of the suspected material has proved quite negative.

A noteworthy feature is the absence of any observation of blood-parasites, whether among aquatic (marine) or terrestrial hosts, although we understand that a good look-out was kept for such. The explanation of their absence among terrestrial animals may be, perhaps, that there is a lack of (insect) transmitting agents.

---

* Manuscript received February 26, 1920. [S.F.H.]

MASTIGOPHORA.

Sub-Class FLAGELLATA.

Order BINUCLEATA.

Family BODONIDAE.

Cryptobia trematomi, n. sp. Pl. I, figs. 1–4.

Distinguishing Characters.—A Binucleate Biflagellate, with the longer, posteriorly directed flagellum attached to the side of the body for part of its length; no undulating membrane, however, is developed. The body averages about 15μ by 3$\frac{1}{2}\mu$ in size. The anterior flagellum is usually from 20–25μ long; the posterior one (including the attached portion), from 40–45μ long.

Habitat :—Stomach and ascending intestine of *Trematomus bernacchii*.

This Flagellate occurred in the mucus of the stomach-wall and ascending intestine. The parasite was observed on five occasions; but the notes made at the time of the observations are only brief. The first runs: "small Flagellates in ascending intestine; movements like *Trichomonas*." The next is, "great numbers of Protozoa, Flagellates." The characters of the parasite were more definitely ascertained during the remaining observations, thus: "numerous bi-flagellates, like *Trypanoplasma*, in the mucus of stomach-wall; some individuals long and slender, very active, others broad, others rounded." Accompanying the last reference are rough sketches which indicate that one flagellum (the anterior one) is free and directed forwards, the other being attached to the body, with a free portion directed backwards, *i.e.*, a trailing flagellum. No undulating membrane is shown. Permanent preparations of the parasites were successfully obtained only on two occasions. We have no doubt, however, that the same parasite was observed on all occasions; the first comparison with *Trichomonas*, when no definite characters were ascertained, not having any significance.

Unfortunately, the four permanent preparations we received proved rather unsatisfactory. The films had all been fixed in osmic acid-vapour (4 per cent.); two of them had been stained by Giemsa and two by iron-haematoxylin. The former were poorly fixed and very faintly stained, and contained extremely few parasites; these were practically useless. The latter were, at any rate, as regards some individuals, better fixed, but the iron-haematoxylin-stain, after osmic vapour, was not very successful. In conversation, Surgeon-Commander Atkinson has recently informed us that these preparations, when examined shortly after being made, were very fairly stained; but that, on looking at them again after his return to England, he was disappointed with them—they seemed to have faded. As a matter of fact, we have had the greatest difficulty in determining the presence of a kinetonucleus, the first essential for this parasite to be placed in the Binucleata, as a *Trypanoplasma*-like form; and it was not until after we had carefully scrutinized many individuals that we

eventually found two or three in which this organella could be definitely made out, though very faintly stained.

The body has a more or less spindle-like shape, the extremities usually tapering (Pl. I, fig. 2), but bent or contorted forms are often found, with blunter ends (fig. 3). As indicated by the observations made on the living parasite, it appears to be very metabolic, and to change its shape readily. The average size is about 15μ by 3$\frac{1}{2}\mu$; the individual shown in fig. 4 is rather larger than usual, being 18μ by 4μ. The parasite possesses two flagella, both inserted into the body at or near the anterior end. One, the shorter of the two, is completely free and directed anteriorly; the other, the longer one, is attached to the body throughout the length of the latter, and then becomes free, being directed posteriorly in the usual manner. The length of the anterior flagellum in fig. 2 is 20μ; that of the posterior one, 42μ. The flagella of fig. 4 are, respectively, 25 and 43μ long.

The proximal portion of the posterior flagellum is closely attached to the body, and follows its regular contour; there is no evidence whatever of the presence of an undulating membrane. We certainly consider that no membrane is developed in this parasite. Atkinson has also informed us that, from his own recollection, he would be inclined to say that no membrane was present. As is well known, the undulating membrane in *Trypanoplasma* is usually well-developed and conspicuous, both in the living parasite and in stained preparations.

The cytoplasm often contains several deeply-staining chromatoid, or meta-chromatic granules (figs. 1–4). In figs. 3, 4, the cytoplasm has shrunk a little, in places, away from the periplast; and the latter is somewhat wrinkled (as shown by the curving lines).

The trophonucleus is generally well-stained, and its structure is easily seen to be of the "protokaryon" type, common among allied Hæmoflagellates. There is a single, large central karyosome, containing most of the chromatin, which is suspended in the centre of the nucleus by radiating linin-strands, more or less regularly arranged. These fibrils pass to the distinct nuclear membrane at the periphery.

As there is never any difficulty about distinguishing the trophonucleus, it is rather surprising that the kinetonucleus should have lost the stain to such an extent that it is often impossible to make out this organella. Where discernible, it has the form of an elongated rod (figs. 1, 2, 4), very faintly stained but apparently homogeneous in character; and that is all we can say with regard to it. The kinetonucleus is single in those individuals in which we have observed it; but in fig. 2 it is slightly constricted in the middle, and may be about to divide into two parts. A fragmented condition of the kinetonucleus is not infrequent amongst these binucleate biflagellate forms. The available preparations are not sufficiently good to enable us to say anything as to the relation of the flagellar insertions to the kinetonucleus; nor have we been able to detect any basal granules, though such are doubtless present.

We have not observed any stages of division in our material.

To what other intestinal Biflagellate are we to consider that this new form is most nearly allied? It bears, obviously, a general resemblance to *Trypanoplasma*, but differs therefrom in one important character—namely, that no undulating membrane has been developed between the attached flagellum and the body. The late C. H. Martin, in his useful comparative account of intestinal Biflagellates,* regarded the absence of a definite membrane as a sufficient distinction to make the inclusion of such a form in the genus *Trypanoplasma* inadvisable. For that reason he separates the intestinal parasite of *Cyclopterus lumpus*, commonly known as *T. ventriculi*, as *Heteromita dahlii* (the specific name *dahlii* having, apparently, priority over *ventriculi*). Martin was, however, in error in referring this species to the old genus *Heteromita*. This type, which has been recently redescribed by Woodcock,† is entirely distinct. In the first place, it possesses no kinetonucleus, and therefore is not a Binucleate; further, the longer, posteriorly directed flagellum is not even attached to the body. Another point in which the parasite of *Cyclopterus* differs from *Trypanoplasma* is that, according to Martin, it possesses a mouth, clearly distinguishable in life. We are unable to say whether the parasite from *Trematomus* has an oral aperture or not; we have certainly not observed anything of the kind in any of the individuals on our films. It must be admitted that Martin's figures of *ventriculi* (or *dahlii*) are not very convincing in this respect. The typical, single individuals figured (not commencing division) show no sign of an oral aperture; nor in any of the figures is there any indication of ingested food-particles (bacteria, etc.) in the body. Nor is the presence of such a cytostome referred to in the earlier accounts. We are of opinion that confirmation in regard to this point is still needed—*i.e.*, whether there is a distinct mouth, apart from the little depression, often apparent at one side of the "beak"-like projection of the anterior end, in many of these Trypanoplasmatine forms.

We think it most probable that the parasite of *Trematomus* is very similar in type and closely allied to the form from *Cyclopterus;* and that it is preferable to keep both distinct from the genus *Trypanoplasma.* The biflagellate parasite of snails, commonly known as *Cryptobia* (or *Cryptoicus*) is, so far as can be gathered from a comparison of the published descriptions and figures, a very similar type to the two forms above mentioned. The posterior flagellum is attached, but it cannot be said that a definite undulating membrane is developed. In this type, certainly, there appears to be no oral aperture. Martin regards this parasite from snails as distinct from the genus *Trypanoplasma*, and in this view we concur. It appears to us that both the parasite from *Trematomus* and that from *Cyclopterus* agree more closely in character with *Cryptobia* than they do with *Trypanoplasma*, and that they are best placed, at all events provisionally, in the former genus. There is no doubt that further study of all these non-haemal Trypanoplasmatine forms is required, particularly with regard to their life-cycle. At any rate, both in regard to our own parasite and in regard to *ventriculi*,

* Quart. J. Micr. Sci., vol. lix. 1913, p. 175.

† Phil. Trans. Roy. Soc. B 207, 1916, p. 395.

we consider it premature to create a new genus, distinct both from *Cryptobia* and *Trypanoplasma*, on the evidence so far available.

On the other hand, the parasite from *Trematomus* is, in all likelihood, a distinct species, and we therefore propose for it the name *Cryptobia trematomi*, n. sp.

SPOROZOA.

Sub-class TELOSPORIDIA.

Order GREGARINIDEA.

Family SELENIDIIDAE.

Selenidium parvum, n. sp. Pl. I, figs. 5–12.

Distinguishing characters.—A Monocystid Gregarine, completely intracellular during part of its trophic life. In the free condition the body is somewhat variable in form ("nematoid"), but usually tends to be slightly curved. The anterior end is narrowed and appears like a short proboscis. About 20 superficial, longitudinal striations (myonemes) are present. (Schizogony and sporogony have not been observed.)

Habitat:—The hinder part of the intestine of an undetermined Polychaete.

This Gregarine, which is most probably a new species, was found in three specimens of a Polychaete, dredged in 150 fathoms, off Inaccessible Island.* Atkinson's notes at the time of observation are as follows:—"The intestine contained numerous Gregarines towards its hinder end. These had a protruding end, and a slowish, side-to-side movement, mainly from the other end. Variation in form was very marked. The parasites were free within the gut."

The material we received comprised two slides. Both of the films had been fixed in osmic vapour (1 per cent.); one of them had been stained with haemalum, the other with iron-haematoxylin. Unfortunately, the differentiation was not very good.

In our films, the Gregarine occurs both free and in the epithelial cells of the intestine, the latter situation being occupied by the smaller forms only. Two such parasites, completely embedded in the host-cell, are seen in Pl. I, figs. 5, 6. The Gregarine lies between the ciliated, external surface of the cell and the nucleus. At times it tends to lie obliquely, distorting the host-cell laterally. The parasite is elongate-ovoid in shape, that of fig. 5 being 29μ by 12μ in size, and that of fig. 6, 32μ by 10μ. There is no sign of any epimerite, and the body does not show as yet any well-marked differentiation into anterior and posterior ends; though in fig. 6, the basal end is slightly narrower or more tapering, and is probably to be regarded as the

* This corresponds with official Station No. 320, and the bottle of Polychaetes from this locality consists mainly of Sabellidae.

anterior extremity. The corresponding end in the other parasite (fig. 5) shows a few granules. The nucleus is relatively large and vesicular and possesses a single, prominent, rounded karyosome. We should say that soon after this stage (which is the only intracellular one that we have been able to find), the parasite becomes free in the lumen of the intestine.

Slightly larger, free forms are seen in figs. 7, 8 ; these are, respectively, 32μ by 13·5μ and 38μ by 10·5μ in size. The body is usually somewhat curved, having the so-called comma-shaped form ("*Selenidium* en virgule" of Caullery and Mesnil). Anteriorly the body narrows sharply and ends in a characteristic snout-like process. But we have never been able to detect any delicate evaginated tip to this proboscis. The cytoplasm of this region has a somewhat different appearance from that of the rest of the body ; it is looser and more alveolar, less densely granular (cf. also fig. 9). In well-fixed and stained individuals, the prominent superficial striations, which run longitudinally and most probably indicate myonemes, are clearly visible. Nine are usually seen, both on the upper and lower surfaces ; allowing for the occurrence of one or two additional ones, at the edges, the total is about twenty. These well marked striations are very characteristic of *Selenidium* ; and the number given by Brasil, in his important paper on *S. caulleryi*,* is also about twenty. The nucleus is situated usually in the hinder part of the body. It is always ovoid in shape (cf. figures), its longer diameter being invariably parallel with the longer axis of the body. This is a point of distinction between this species and *S. caulleryi*, where, in the corresponding phase, the longer diameter of the nucleus always lies transversely to the length of the body (cf. Brasil's figs., *l.c.*). In another form, *S. pendulum*,† however, the nucleus is parallel with the longer axis of the body.

The largest adult forms we have seen measure from 48μ to 55μ in length by from 16μ to 19μ in width (figs. 9, 10). These dimensions are distinctly smaller than those of *S. caulleryi*, or other species. Occasionally these larger individuals do not show a snout-like anterior end ; whether this is withdrawn, or the shape of the body modified, or whether the appearance seen is the result of alteration during fixation, we are unable to say.

The only other stages we have found are two instances of what appear to be definitely encapsuled forms (figs. 11, 12). These are medium-sized parasites and both possess a well-marked snout. In the case of one individual (fig. 11), this process is curved and applied to the adjacent side of the body, probably on account of the enclosing capsule ; but in the other case (fig. 12), the capsule is also prolonged at this end, following the outline of the snout. We have felt somewhat in doubt as to the nature and significance of this envelope. This stage certainly cannot be regarded as a sporont-cyst, inside which gametogony and sporogony will take place, because, in both instances, only one parasite (sporont or gametocyte) is present. Neither, we think, can

* Arch. Protistenk., VIII, 1907, p. 376. † *Op. cit.*, XVI, 1909, p. 106.

it be considered as a schizont-cyst; because, according to what is already known concerning the life-history of the Selenidiidae, schizogony occurs while the parasite is still intracellular, or, at any rate, intra-epithelial. Moreover, the individuals which are present in our preparations, possessing the characteristic shape and the myoneme-striations of the gametocyte or sporont in other species of *Selenidium* must, we consider, also be regarded as representing the same phase.

We are inclined to think that the envelope enclosing these individuals is a kind of false membrane, most probably derived from the host-cell, inside which the parasite has grown to this stage. In other words, it represents the remains of the infected epithelial cell, part of which, immediately surrounding the Gregarine, has become modified in this way. The rest of the disorganized cell has been broken away and left behind. It will be observed that, in the case of the intracellular parasite of fig. 6, the cell-protoplasm, particularly on the right, has been altered into a sort of thick envelope surrounding the Gregarine. Probably this envelope is ruptured at a later stage, in cases where this has not already happened.

As indicated, we regard all the forms we have found as representing different stages in the growth of the gametocyte or sporont. We have not observed association, cyst-formation, or sporogony. Neither have we been successful in finding, in our very limited material, any stages in the schizogonous part of the cycle; though, from what is known of other species, and especially of *S. caulleryi*, with which it seems probable that our form shows fairly close agreement, there is no reason to suppose that schizogony is lacking. It may be that, in the case of the particular infection from which our films were prepared, schizogony was nearly over, and most of the parasites were in the sporont-phase.

In conclusion, although we have not obtained cysts or spores, there can be but little doubt that this parasite, on account of its characteristic appearance and morphology, is a *Selenidium*. Provisionally, we consider it best to regard this form as a new species. It differs from *S. caulleryi*, *mesnili*, or *pendulum* in the size of the sporonts, supposing, that is, that the largest individuals we have observed are nearly adult. Further, the Polychaete in which our form occurs, although it has not been possible to determine it more closely, is quite likely to be a new host of *Selenidium*. For this form, therefore, we propose the name *S. parvum*, n. sp.

CILIATA.

Order HETEROTRICHA.

Family STENTORIDAE.

Haematophagus megapterae, n.g., n. sp. Pl. I–III, figs. 13–65.

Distinguishing characters.—A large, tubular Ciliate, parasitic on the baleen-plates of the Humpback Whale (*Megaptera nodosa*). Habit of life, mainly sedentary, the animals being usually inside a clear, delicate envelope, from which, however, they can

quickly liberate themselves and swim away. This Ciliate feeds exclusively on the red blood-corpuscles of the whale, and produces masses of pigment, similar in appearance to "melanin."

There is a prominent adoral zone of strong cilia, generally fused into membranellae. The body is covered with short cilia. There is a well-marked pharyngeal depression at the anterior end, in the middle of the peristomial region. Usually, a single, large, round or ovoid macronucleus is present, with a single, small micronucleus closely applied to it. The parasite shows considerable polymorphism of size and form. Division takes place, either by binary, or by multiple transverse fission. The mode of conjugation has not been observed.

Description.—This Ciliate, which is by far the most important and interesting parasitic Protozoan discovered by the "Terra Nova" Expedition, was found by Mr. D. G. Lillie on the baleen-plates of two or three Humpback Whales caught off the Bay of Islands, New Zealand,* in August, 1912. Together with the material, we received a paper of rough notes and sketches made by the discoverer. The following observations are taken from his notes. "The length of the Ciliate [*i.e.*, of the fully grown form] is as much as 1·5 mm. when in its tube, and 1 mm. when free swimming. The tube in which each lives may be much longer—from 2·5 to 3·5 mm. The animals can run up and down their tubes. They project the head out of the mouth of the tube and waft food into the mouth by the large cilia. The red spheres [present in the body] may be whale's blood-corpuscles. Very few without them, The animals on being shaken up [*i.e.*, in the glass receptacle containing them] come out of their tubes and swim freely. They have power to develope (excrete) clear tubes very quickly. One individual fixes itself to the side of the container (or to the baleen-plates) by its posterior end, then others congregate around it and the patch grows like a super-cooled liquid crystallizing out. They could thus cover a square 5 mm. by 5 mm. in about twenty minutes. By this means a scum is formed over the baleen-plates, which grows in thickness by the animals elongating their tubes. The animal has the power to alter the shape of its body to some extent."

Some of the material received had been fixed in formalin, and some in sublimate and acetic. We have stained and mounted several samples from both lots; but all our preparations show the same kinds of forms. As stains we have used carmalum, which gives an excellent general result; Delafield's haematoxylin and iron-haematoxylin, which show up the cilia, basal granules, etc., and also the tube or envelope well. Sections have been cut and stained by iron-haematoxylin.

The large, full-grown, trophic forms have invariably a long, tubular shape, the width of the body remaining practically the same for the whole length of the animal (Pl. I, fig. 13). The largest specimens found in our stained preparations measure about 1 mm. long by about 90μ broad. The individual figured is about ·65 mm.

* This corresponds with Official Station 149.

long and about 70μ broad. Roughly speaking, these tubular forms are generally about ten times as long as they are wide. They are readily visible to the naked eye.

The parasites are always enclosed in a long, delicate, transparent envelope, which can be rapidly formed by a secretion of the Ciliate (cf. above). This secretion is most probably of a gelatinous, more or less sticky nature. Our material consists of a mass of adhering and entangled parasites, of all forms (doubtless some of the scum mentioned by Lillie), and our preparations are made from small portions of this, carefully separated and sub-divided. The tubular envelopes of these large forms are often much longer than the parasites themselves; but, naturally, the empty parts are often twisted and entangled among other tubes, or else broken off. The longest envelope which we have been able to trace in its entirety was about twice as long as the particular individual contained in it. In the case of nearly all these large, trophic forms, the anterior end of the parasite is about on a level with the orifice of the envelope. We have never seen the Ciliate projecting far out of its envelope; at most, the adoral ciliary zone projects very slightly. On the other hand, the parasite is often found withdrawn some distance inside the investing tube (cf. figs. 14, 15); when in such a position, the body is not in any way contracted. The width of the envelope is usually only very slightly greater than that of the enclosed parasite.

Encircling the anterior end of the body, and constituting a peristomial or adoral zone, is a prominent ciliary ring. We have not been able, from our fixed material, to determine whether this ring is in reality a spiral, or not; it probably is, but it must be a very close, ring-like spiral, and we cannot say whether it is right- or left-handed (*i.e.*, dexiotrichous or scaiotrichous). At any rate, this zone does not converge on the buccal aperture. Usually, this adoral zone takes the form of large, strong cilia, more or less free (figs. 13–15); but in some cases it is clearly composed of a series of membranellae, formed of fused cilia (fig. 17); in the other cases, the membranellae are to be regarded as having broken down more or less into their component cilia. This peristomial region is not in any way expanded into a saucer, or disc, as in *Stentor*; still less is there any sign of wing- or arm-like folds, as in *Folliculina* (*Freia*).

The entire surface of the body of these large forms is uniformly covered with short, fine cilia (figs. 20 and 22, a transverse section); though they are not always readily visible, because of the closely applied envelope. Each cilium originates from a conspicuous basal granule (fig. 18). When the edge or side of the body is almost in focus, a curious ribbing, or transverse striation is seen; we consider this to be largely an optical effect, due to the apparently closely apposed rows of basal granules (fore-shortened in a transverse sense). In these large trophic parasites, a surface-view does not show the longitudinal arrangement of the basal granules (and cilia); but in ovoid, "resting" forms, the arrangement of the basal granules in longitudinal rows is clearly seen (Pl. II, fig. 34; Pl. III, fig. 50).

We have not been able to detect any definite myonemes; such may be present, but we feel sure that they are very poorly developed. For in none of our preparations

is there any indication of the possession by this Ciliate of the power of sudden contraction, as a whole; in this respect, it is quite unlike *Stentor*, and certain other large forms. In our opinion, the contractility of *Haematophagus* must be very slight.

In the centre of the anterior end is a conspicuous depression, or pharynx, leading downwards from the mouth into the interior of the body. This pharyngeal cavity has a well-marked V-shaped appearance (figs. 14–17), the sides or limbs of the V being defined, very often, by numerous, deeply staining, longitudinal striations. These striations do not indicate, in our opinion, definite, firm rods supporting the pharynx; they are not, we think, quite comparable with the rod-like apparatus developed specially in connection with the pharynx in the case of many Gymnostomatous Holotricha (*e.g.*, *Chilodon*). They have not a sufficiently rigid, regular appearance. In some cases, they seem to be more spread out, or scattered (the angle of the V being larger), than in others; sometimes they tend to curve slightly. In some individuals, again, they are very ill-defined; we have chosen for illustration individuals which show these striations clearly. We regard these striations as representing well-developed basal fibrils of the membranellae, such as have been described by Schröder in the case of *Stentor*. They are probably contractile, and serve to retract the adoral apparatus (membranellae, etc.), when the latter is not functioning. They probably also support, to some extent, the pharynx. In the ovoid forms (described below), where the adoral apparatus is retracted, or not well-developed, these fibrils are more compact, and arranged more in the form of a tube than of a V.

A clear distinction between ectoplasm and endoplasm (*i.e.*, "cortex" and "medulla") is not noticeable. The general cytoplasm (endoplasm) of the body usually differs in appearance in the anterior and posterior halves. In front of the nucleus, it is somewhat denser and more compact, and takes up the stain a little more deeply. Behind the nucleus it has a looser, thinner appearance, and stains more faintly.

The macronucleus in these large tubular forms is always single, round or slightly ovoid, and relatively large. It is situated near the middle of the body, if anything slightly in the anterior half. It stains fairly intensely and in this respect stands out distinctly from the other contents of the cytoplasm; it is, however, in these forms, rather "loose" in appearance—by no means dense and compact in character. It is for the most part finely granular, but it usually contains a number of more prominent grains, varying in size, which are undoubtedly small karyosomes (figs. 19, 20). In carmine-stained preparations each karyosomatic grain is seen to be surrounded by a narrow, clear zone or halo, but this is not apparent in sections stained by iron-haematoxylin (fig. 22). In regard to its simple form, the macronucleus of *Haematophagus* agrees with that of *Folliculina* and differs from that of *Stentor*.

There is a single, very small micronucleus (*m.*, figs. 19, 22), which is closely applied to the macronucleus and sometimes lies in a slight hollow or depression at the margin of the latter. It stains very faintly and frequently cannot be made out; in

such cases it probably lies either on the upper or lower surface of the macronucleus, as seen in the particular individual.

The most striking features shown by these large tubular parasites are the numerous mammalian red blood-corpuscles and the clumps of pigment produced by their digestion, both of which are invariably present. *Haematophagus* is a selective feeder on red blood-cells, and on these alone. We have never seen even leucocytes ingested. And no other kind of food-material whatever has been observed in the body of these parasites. The freshly ingested blood-cells, still unaltered in colour, are found in the anterior part of the body, chiefly in the first third or so (figs. 13–17), this region being sometimes gorged with them. In fig. 16 two or three cells are seen passing down the pharyngeal depression.

One noticeable alteration, however, has already taken place at this early stage, *i.e.*, before the digestion of the haemoglobin has begun. There is very great variation in the size of the masses of blood (cf. fig. 15–17). What happens is as follows (cf. fig. 21 a–d, magnified more highly) :—As soon as the red cells pass from the pharynx into the endoplasm, they become enclosed in food-vacuoles. In each of the food-vacuoles, there may be one, or a few, or many blood-corpuscles (fig. 21 a) ; large vacuoles, with numerous corpuscles, being quite frequent in these large parasites. In these larger vacuoles the corpuscles become compressed and, as it were, moulded together, fitting into each other like a spherical mosaic (fig. 21, b, c). Ultimately, probably as a result of the dissolution of the " skin " of the cell, the haemoglobin-containing substance of all the cells in a vacuole merges completely into one large, homogeneous mass, varying in size, of course, according to the original number of red corpuscles in the particular vacuole (fig. 21, d).

As the digestion of the homoglobin proceeds, pigment is formed. This pigment, which is to all appearance similar to the " melanin " produced by certain Haemosporidia, may be either in the form of small, angular particles (fig. 21, e), or in clumps composed of such particles closely aggregated (fig. 30), or, finally, in almost homogeneous solid blocks (fig. 20). The pigment lies mainly in the posterior half of the body (fig. 13), behind the nucleus ; but in some individuals its production may begin while the food-vacuoles are still in the anterior half of the body. The food-vacuoles are evidently passed gradually backwards, down the body, as digestion proceeds. The masses of haemoglobin-substance gradually lose their colour (showing that the haemoglobin is being absorbed), and the pigment-grains make their appearance in immediate relation with the red " cell " which is being digested ; the larger the mass of haemoglobin the greater the amount of pigment ultimately produced. The pigment is apparently formed on the outside of the vacuole, *i.e.*, in contact with the body-cytoplasm ; for, when digestion is quite completed and the entire contents of the mass of blood absorbed, colourless empty vacuoles are left, which seem to possess a definite wall or envelope, in contact with which are the pigment-grains (figs. 20, 21, e). The pigment is never seen inside the vacuole. As these empty vacuoles pass backwards they are often drawn

out into narrow tubes, or even streaks, still with scattered pigment-grains attached to them (fig. 19). Finally, nothing but the clumps and blocks of pigment are left. *Haematophagus* is unique among Ciliates in producing "melanin"-pigment as a result of the digestion of red blood-cells; and, indeed, apart from the well-known malarial parasites and an allied Haemosporidian, so far as we are aware, there is not another known Protozoan which can do so.

Occasionally, one or two definite, colourless crystals are seen in the body of the parasite (figs. 19, 20); these are more or less acicular in form, and are probably some organic excretory product, derived from the ingested blood.

We have no evidence that an anus is present in these large parasites, and certainly there is no morphologically defined organella of that nature apparent. We are inclined to doubt whether any "functional anus" is present, because no aggregations of excreted pigment are ever seen in the tubular envelope behind the body. We state below in what manner we consider the masses of this excretory product are, for the most part, ultimately got rid of.

We consider, also, that the other characteristic Protozoan organella concerned in excretion—namely, the contractile vacuole, is lacking in this Ciliate. We ought, certainly, to have found the contractile vacuole in some individuals, if it occurred. In regard to the absence of a contractile vacuole, *Haematophagus* agrees with many other parasitic Protozoa, which live entirely on the cells or fluids of their hosts.

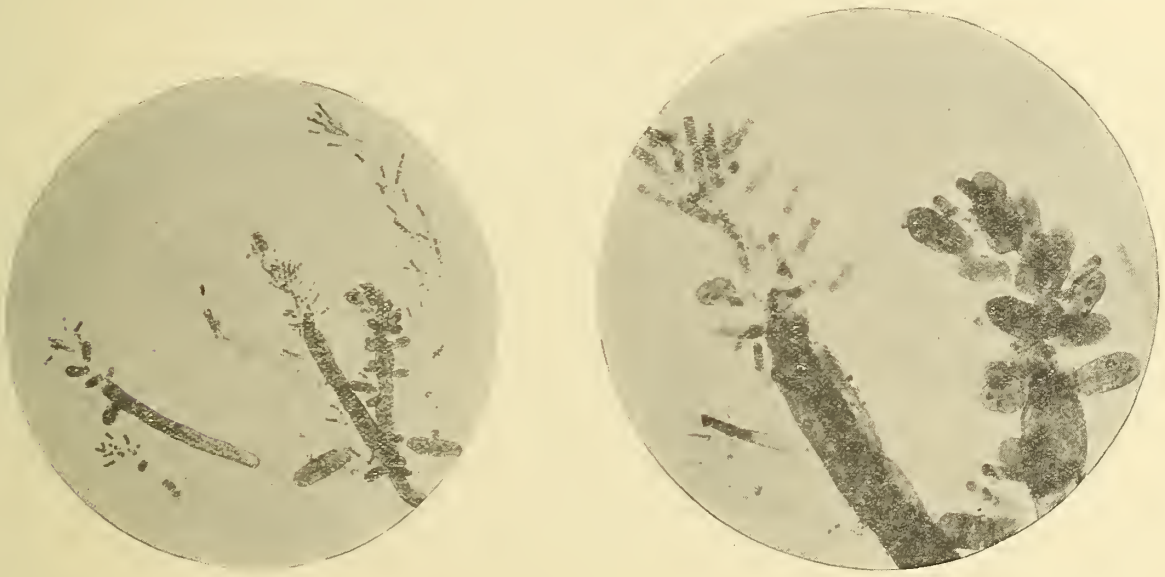
Besides the large tubular form described, another trophic (*i.e.*, actively feeding) phase of the parasite is present in great numbers in our material. This is a very small form, and represents the youngest stage in the life-cycle. Its shape may be tubular (figs. 23, 24), but frequently approximates to that of a slender vase, swelling slightly, in the posterior or basal region (figs. 25, 26). The length of most of these individuals varies from about 80 to 120μ, and their greatest breadth from about 17 to 30μ. One of the smallest parasites seen (fig. 27), resulting from a recent division, is only 37μ by 13μ. The difference in size, therefore, between the two extremes, among the trophic forms, is very great, the largest individuals being more than twenty-five times as long as the smallest.

These small tubes or vases are often found clustering round the anterior end of an adult trophic form, adhering, invariably by their basal end, to the envelope of the large individual; sometimes they are seen still attached to empty tubes (cf. Text-fig. 1). It is probable that they are attracted to the anterior end of the large forms by the prospect of food-supply. These small, delicate individuals may be unable to obtain, directly for themselves, red blood-cells from the whale, and may be dependent for their food on "the crumbs which fall from the rich man's table"—in other words, the corpuscles in the vicinity which remain undevoured by the large Ciliates.

The small forms differ from the others in one or two respects. They possess the adoral zone of strong cilia and a fine ciliary covering to the body generally (Pl. II, fig. 28), but the adoral cilia never appear to be united or fused into membranellae.

Further, they do not show any well-marked pharyngeal depression; nor is there, of course, any sign of the vertical striations which represent the basal fibrils of the membranellae of the large parasites.

The investing envelope of these little vases is usually about the same length as the contained Ciliate, rarely longer. The posterior end of the parasite is always near the basal end of the tube (figs. 23–28). A characteristic feature is the presence of a large vacuole, or, rather, a clear space, occupying most of the posterior half of the body, often commencing just behind the nucleus (figs. 23–28). Usually, this space seems to be enclosed for the most part only by the limiting layer of the body, the general cytoplasm



A. B.

Text-Fig. 1.—Microphotographs. (A, × 30; B, × 100, approximately).

A. General appearance, showing the different types of form of the Ciliate; large tubular parasites; ovoid forms; and small tubular forms. Note how the small forms are attached to the gelatinous envelope of the large tubular parasites.

B. A portion of the same field, more highly magnified.

thinning out rapidly at the sides, anteriorly. (This is the region which, in the large forms, is occupied, or to some extent filled up, by diffuse, paler-staining cytoplasm.) What the meaning or function of this large space may be we are unable to say; it is certainly not contractile.

The macronucleus is much more compact and dense than in the large parasites, and no karyosomatic grains have been observed in it. We have been unable to make out a micronucleus.

Sometimes there may be two, three, or even four proportionately smaller nuclei (macronuclei), situated close together near the middle of the body (fig. 24), instead of a single, larger one; this occurrence is probably the prelude to division.

The young parasites naturally do not engulf so much blood as do the adult forms. At most four or five corpuscles are seen in a vase (figs. 23, 24); each is usually in a small food-vacuole by itself, but occasionally two or three are merged together in one rather larger vacuole.

In correlation with the presence of the large space in the posterior half of the body, the pigment is all in the anterior half of the body. It is always in the form of fine grains, more or less generally distributed (figs. 23, 24). In connection with these small parasites there is frequently a cluster of excreted pigment-grains at the basal end, lying definitely outside the body-wall, between it and the investing envelope (figs. 23–25), and often adherent to the envelope. They have probably been extruded from the body, anywhere in the anterior half, and wafted backwards, inside the tube, by the fine cilia.

A considerable gap exists in our material between the full-grown trophic forms and the very small, vase-like ones. No intermediate or transitional stages, representing growing forms, have been seen. We consider that the little forms certainly grow up into the large tubes, but we are unable to say whether they remain in the trophic condition, *i.e.*, actively feeding, throughout this period.

On the other hand, numbers of forms and stages are present, which indicate more or less continuous successive division, during a period when the parasites are not actively ingesting red blood-cells; as a result of these successive divisions, which probably occur at short intervals, there is a steady diminution in size of the parasites, from the largest down to the smallest forms.

In the first place, we find large ovoid forms (Pl. II, figs. 31–34), either fairly slender and elongate, or relatively short and broad—much shorter and distinctly broader than the largest tubular forms. These forms, also, are surrounded—probably always—by the delicate gelatinous envelope, but owing to their expansion in width, this cannot usually be clearly made out; the envelope is seen, however, in fig. 31, around the anterior end of the body, and also in fig. 32, at the sides of the constriction. We take this opportunity of mentioning that we should not like to affirm that we have seen a single individual, which is "free," *i.e.*, not enclosed in an envelope; every stage which we have found is normally thus surrounded. The emergence of the Ciliate from its tube, to swim about freely, as described by Lillie, probably occurs only seldom, and in response to some particular stimulus. And, as he remarks, this free-swimming period is very short, the parasite soon settling down again to a sedentary condition.

In these large ovoid parasites, as in those of all sizes in this phase, the general body-covering of cilia is absent. But the basal granules of the latter persist, and can be seen, arranged in longitudinal rows, in a surface view of well-stained individuals (fig. 34). The membranellae and their basal fibrils, surrounding the pharynx, are at first present, but in a retracted, non-functioning condition (cf. fig. 32, where the vertical edges of the membranellae, arranged in a circle, are seen from in front, slightly obliquely; and fig. 31, where they and the basal fibrils are seen laterally). But the

interesting point is, that this anterior end of the body, with the associated apparatus, is undoubtedly got rid of by a simple constriction of the body in this region (figs. 32, 33). Thus result the shorter, and relatively broader, ovoid individuals, in which there is no sign of the above structures.

The macronucleus in these "resting" forms has a quite different appearance from that seen in the case of the long, tubular forms. It is dense and compact, stains very deeply, and shows no karyosomatic granules (figs. 31, 32). The small micronucleus (*m.*) can sometimes be seen closely applied to the edge of the macronucleus (figs. 32, 35, 36).

The contents of the cytoplasm show a very interesting condition. In the first place, the body never contains huge food-vacuoles, in which lie many blood-cells, or a large mass of blood, such as are often present in the long parasites. Nevertheless, the cytoplasm may be nearly filled with red blood-cells, for the most part in small vacuoles, *i.e.*, containing one or two, or occasionally a few, blood-cells (figs. 31, 35, with which contrast figs. 14–17). On the other hand, the cytoplasm of these ovoid individuals may be filled with smaller inclusions, practically uniform in size, and staining fairly intensely (fig. 36). Or, finally, the cytoplasm may have, generally, a coarsely granular appearance, but one can no longer speak of definite inclusions (fig. 32); in such a case, the cytoplasm itself stains much more deeply than does that of the tubular forms.

There seems to be no close relation between the presence or absence of the pharynx and adoral apparatus and the condition of the cytoplasmic contents. Thus, in figs. 31, 32, in both of which the adoral apparatus is still present, the former shows the body filled with perfectly definite blood-cells; the latter shows uniform, coarsely granular cytoplasm only. On the other hand, of the parasites depicted in figs. 35, 36, both of which have lost the adoral end of the body, the former is full of definite blood-corpuscles, while the latter has the cytoplasm in the intermediate condition described above.

At no stage do these blood-corpuscles (or the small aggregations of them) appear pale and partially digested, in the manner customary in the case of the tubular forms; nor are any pigment-grains developed in direct relation with them. Indeed, a striking feature in all these forms is the scantiness of the pigment. There may be none whatever (figs. 33, 34); usually, there are a few sparse granules (figs. 31, 32); while fig. 35 shows much pigment for this stage.

What is the explanation of this cytoplasmic condition, and of the changes that evidently take place, in these large "resting" forms? We consider that the progress of digestion is in some way modified or delayed, and the metabolism of these parasites is, temporarily, not carried on so vigorously as in the case of the actively ingesting and digesting, tubular forms. As a result, the food-material is not entirely used up, with the formation of the ultimate excretory product of complete metabolism, namely, the pigment; the food, *i.e.*, the blood, seems, rather, to be gradually absorbed into the general cytoplasm and there stored up, for the time being, in the form of reserve-material, for use as required. The very small quantity of pigment sometimes present

is, we consider, the residuum that happens to be left in the anterior half of the body, when the transformation of the tubular Ciliates into these ovoid forms takes place.

How is this transformation effected? If these ovoid forms are derived from the long tubular parasites, what has become of all the masses of pigment invariably contained in the body of the latter? We have not succeeded in finding as many transitional stages as could be desired, but we think there can be no doubt that the first act is the self-amputation by the parasite of the posterior half of the body, *i.e.*, the greater part behind the nucleus, with nearly all the pigment and empty food-vacuoles. This takes place, most probably, by a simple process of constriction, in the same manner as the anterior end, with the adoral apparatus, is cut off subsequently. Pl. II, fig. 29, shows a tubular form, only half the customary length, which has thus lost the posterior portion of its body (cf. the position of the nucleus, which is never seen in the posterior half of the ordinary tubular parasites). We have no reason to suppose that this is other than a normal phase. The new hinder end is definitely rounded, and constituted of compact cytoplasm; there is no sign of any accidental damage to the parasite, *i.e.*, the posterior half has certainly not been broken off accidentally in manipulation.

In the above individual the adoral zone is still functioning. The body is by no means filled with red blood-cells, and it may be inferred, perhaps, that the Ciliate would have continued to ingest them, in smaller vacuoles, each containing at most very few corpuscles, until its cytoplasm was more or less distended with them, when the adoral apparatus would have been retracted and the parasite would assume the "resting," ovoid condition. In the parasite shown in fig. 32, the nucleus is also situated posteriorly and has not yet taken up the median position which it occupies at a slightly later stage (cf. figs. 34–36).

The parasite drawn in fig. 30 has already lost its anterior end, as well as most of the posterior part of the body. There is, however, much more pigment left than is usual in a typical ovoid form; whether this individual could still eliminate much of its pigment, we are unable to say. The ovoid forms occasionally eliminate what little pigment is left (cf. fig. 36, where the remaining pigment has been extruded into the space between the body and the envelope).

Unfortunately, we have not managed to find any parasite showing the macronucleus in a transitional condition between the loose, diffuse character of that of the tubular form, with its many karyosomes, and the dense, compact character of that of the resting form. But the above is the only way in which we can account for the development of this stage.

In regard to one point, however, we feel sure. This change is a development—a gradual alteration in the condition and behaviour of the parasite. It does *not* represent a sudden contraction of the tubular body; it does not correspond, that is to say, with the sudden contraction and alteration in shape which *Stentor*, for instance, can effect,

in response to some sudden stimulus. The ovoid form of *Haematophagus* does not return at will to the active, elongate phase.

The assumption of this state is the prelude to a period of active division. These ovoid forms inaugurate a series of successive divisions, by means of which, as already indicated, the size of the individual parasites becomes ultimately greatly reduced.

A stage in the binary fission of one of these large ovoid parasites is seen in Pl. III, fig. 37. The nuclei have divided, and a transverse groove or cleft, wider at one side, has appeared around the middle of the body, by means of which its division into two equal halves would shortly be effected. The division of the macronucleus takes place in a simple manner, by a constriction into two portions, which gradually separate, remaining for a while connected by an elongated band (still seen in the figure). Each of the daughter-micronuclei is in close relation with one of the halves of the macronucleus. We have not been able to observe the actual division of the micronucleus and cannot give, therefore, any cytological details with regard to the process; it doubtless takes place by some form of mitosis, such as is commonly found amongst other Ciliates. Before leaving the question of nuclear division, it may be mentioned that the best indication of the behaviour of the micronucleus at this period which we have seen, has been in the case of a small ovoid form, just commencing nuclear division (Pl. III, fig. 63). Here, the macronucleus is drawn out into a dumb-bell shape and the micronucleus has its chromatin in the form of distinct granules, probably representing small chromosomes; these appear to be arranged in rows upon the developing nuclear spindle.

During this first division of the large ovoid parasites, there is no sign of the re-development of the adoral apparatus. Such an individual as that shown in Pl. II, fig. 36, for instance, is in all probability one of the products of the first division of a larger form. It is just about the same size as each of the halves of the dividing parasite (Pl. III, fig. 37, which is magnified only half as much); further, it will be noted that its macronucleus is only about half the size of that of the large forms in figs. 31–34 (of the same magnification).

However, a part of the adoral apparatus is developed again very soon after; either (subsequently), by the first daughter-individuals, or when these again divide. The parasites shown in figs. 38, 40 may represent either case; from their size it is difficult to say which. At any rate, the body now becomes much more elongated in shape, *i.e.*, a narrow ovoid, with blunt ends. But we have no evidence that there is any growth, or increase in size. The development of the adoral apparatus is not pronounced and seems to be limited to the formation of the contractile fibrils surrounding a pharyngeal depression which is at times well-marked (figs. 38, 42). It is important to note that there is never any development of the membranellae themselves, or of any cilia, whether large or small. The anterior end, equally with the body generally, is always completely enclosed by the envelope. It seems clear, therefore, that in

this phase, the parasite remains inactive and neither swims about, nor ingests fresh blood-cells.

The cytoplasm is always coarsely granular in appearance; it is never filled with blood-cells, nor is it in the intermediate condition described above. Occasionally, however, one or two blood-cells are present; probably these are left over from the larger of the food-vacuoles which sometimes occur in the earlier stage. These individuals usually show a considerable quantity of pigment—distinctly more than in the case of the newly formed, large, ovoid parasites. Metabolism is evidently taking place more actively, the store of reserve food-material being gradually used up with the production of pigment. But, we repeat, we do not think that any fresh blood is ingested during this period, in spite of the presence of the pharynx; if this were the case, we should certainly have found, among the scores of individuals at this stage which have passed under our eyes, some showing an expanded anterior end, possessing cilia or membranellae and not completely enclosed by the investing envelope.

Further transverse division soon takes place. The development of the longitudinal fibrils of the daughter-individual formed from the posterior half of the dividing parasite always occurs at the end next to the line of division, never at the hinder extremity. In other words, the two daughter-individuals are always found, posterior end to anterior end (figs. 39, 41).

Nuclear division at this period frequently takes place to a much greater extent than does the cytoplasmic division; hence, single parasites are often found with a number of macronuclei—from 2 up to 8, the latter being the highest number observed. In such a case, when the next cytoplasmic division occurs, these macronuclei are apportioned out—it may be unequally—between the dividing halves (fig. 41). Unfortunately, we cannot say what happens to the original micronucleus in these multinucleate individuals—whether it remains for a time single, or also divides as many times as the macronucleus. With the exception of the parasite drawn in fig. 38, which possesses a single, conspicuous micronucleus (*m.*), although there are two completely separated macronuclei, we have been unable to distinguish the former organella in these individuals.

As the size of the parasites steadily diminishes by repeated divisions, the macronucleus tends in most cases to remain single and to divide only when the body divides (Pl. III, figs. 46–49); though there are exceptions (cf. fig. 51). Moreover, the development of the pharynx and basal fibrils is now much feebler; there may be only a slight indication of such development (figs. 45, 49), or, frequently, none whatever (figs. 46, 47, 52–55.)

Some of these smaller dividing forms show a variation in regard to the relation of the parasite to the investing envelope. At times, each of the products of division appears to have secreted—at any rate, partially—a new envelope for itself, inside the old one; cf. fig. 48, where an inner investment to each half is seen clearly, turning inwards at the line of cleavage. In other cases, each daughter-individual is enclosed

in a separate envelope, and there is no sign of a common investment (figs. 49, 55, with which contrast fig. 54).

In these smaller division-couples, where the macronucleus of each half is single, the micronucleus (fig. 49, *m.*) is sometimes visible, situated a little distance from the former organella.

An elongated parasite of about this stage (fig. 50), deeply stained, shows, in superficial view, the longitudinal rows of basal granules, just as clearly as these may be seen in the large ovoid forms, although, equally, there is no indication of actual cilia.

The products of the final stages in these successive divisions, when they have separated and become slightly elongated (figs. 56, 57), are now reduced to the same order of size as the smallest tubes or vases above described ; and we have no doubt that they become such, and resume again their active trophic functions. In fig. 57 there is an indication of the development of the clear area or space in the posterior part of the body.

Unlike the large tubular parasites, the small tubular ones may themselves undergo division. This may take place in either of two ways. The little Ciliate may divide while it is still in the active phase, *i.e.*, possessing cilia, etc., and also, incidentally, the clear space (fig. 60). In such a case, the nucleus becomes elongated, like a streak (fig. 58), and after it has divided one portion, together with some of the cytoplasm, passes down one side of the tube and then the protoplasm again spreads across the cell, cutting, as it were, the clear space into two ; after complete fission has been effected, the posterior daughter-individual develops fresh cilia at its anterior end. The small parasite of Pl. II, fig. 27, which fills only half its envelope, is undoubtedly the posterior individual resulting from such a division, left behind in the envelope. The minute parasite shown in Pl. III, fig. 59, which happens to possess no fewer than six nuclei, and a large vacuole, is the very smallest individual form of *Haematophagus* which we have seen. It is only 20μ by 13μ.

On the other hand, a vase-like parasite may lose its ciliary apparatus, and also its clear space, the protoplasm becoming condensed and retracted well within the tubular envelope (fig. 61). Binary fission then takes place in the usual manner (figs. 62–64).

We have observed one, and only one, instance of multiple fission, *i.e.*, simultaneous transverse division of the body into more than two daughter-individuals ; this single observation, however, suffices to prove the occurrence of this mode of division. The parasite in question (fig. 65) is a small tubular form, slightly larger than the usual vase-like individuals ; it still possesses its original ciliary zone at the anterior end. The body is divided into four approximately equal portions, all completely separate, and each possessing a single nucleus and one or two clumps of pigment-grains. From the frequent occurrence of multinucleate individuals, it is possible that multiple fission occurs at times more commonly than is apparent from the examination of our material. There are only few known instances of the occurrence of multiple, transverse fission among Ciliates, *e.g.*, in *Anoplophrya* and allied forms.

As regards conjugation, we have not observed the slightest definite indication of such a process in any of our preparations. As is well known, this important phase in the Ciliate life-cycle occurs only at intervals, in response to changes in the environmental conditions, deficiency in nutrition, etc. And apparently the factors inducing conjugation were not operating in the case of our material, at the time when it was collected. As a matter of fact conjugation is much more readily and frequently observed among free-living Ciliates than amongst the parasitic forms.

At first, we hesitated a little as to whether we ought to regard the smaller "couples," each member of which is apparently enclosed by its own envelope (figs. 49, 55), as indicating conjugation and not division. But we soon concluded, for the following reasons, that these pairs also represented the last stage of division, before the two daughter-individuals had separated. (1) Division is occurring very generally, whereas this would be the only stage in conjugation present. (2) The parasites lie end-to-end, as they are invariably seen in the later stages of division, and never side-to-side, as they are usually found in conjugation. (3) Contrary to what would be expected if conjugation were concerned, this condition is seen only in young forms—not in adults. (4) Lastly, there is no indication of special activity on the part of the micronucleus; in some of these pairs it is not even visible (fig. 55); while the macronucleus appears quite normal.

Biological Note.—The way in which this Ciliate obtains its food—namely, the blood of the whale—cannot be ascertained with certainty. The suggestion has been made to us that *Haematophagus* is not exclusively a haemophagocytic parasite, and that this Ciliate-scum on the baleen-plates was only casually feeding on blood, during the time after the whale was wounded or killed, perhaps after it was drawn ashore. For the following reasons we have ourselves no doubt that this new Ciliate is purely a haemophagocytic parasite, and that it does not normally ingest other food.

(1) *Haematophagus* is essentially a sedentary form and its normal habitat must be on or in connection with the baleen-plates.

(2) If the Ciliates were only temporarily feeding on an unaccustomed diet of red blood-cells after the time when the whale was wounded, it is extremely improbable that *some* individuals would not have been found ingesting or digesting their accustomed planctonic food (cf. above, p. 11).

(3) If this Ciliate feeds on different kinds of small organisms in the sea-water, it is difficult to understand why, when it is presented with blood, not a single individual appears to have so much as sampled a leucocyte.*

---

* In Lillie's page of rough notes and sketches he mentions that two forms of *Vorticella* were generally associated with *Haematophagus*, on the baleen-plates, although we have not found these organisms. Lillie states that "these Vorticella never had red particles." If *Haematophagus* were only casually feeding on the red cells, one can see no reason why some of the *Vorticella* should not also have tried this diet.

(4) The large, tubular forms do not cast out their products of excretion, which are all retained in the posterior half of the body until the individual is full grown and the hinder part of the body is entirely cut off, prior to the commencement of the resting, multiplicative phase. We have no means of estimating how long the Ciliate takes to become full grown, but judging from the difference in size between the large, tubular forms and the small, vase-like ones this must occupy a considerable period, and it is difficult to believe that these large individuals had not commenced their trophic activity and growth before the whales were wounded. In that case we should certainly have found some indication of excretory products, or unused food-material other than pigment, in the posterior half of the body of these individuals, had they been feeding on the microscopic plancton.

(5) The fact that the ultimate excretory product of the digestion of the red corpuscles is the highly specialised melanin-pigment also argues a very special adaptation to red blood-cells, and points to these being the usual food-supply.

(6) It is also difficult to believe that the whole of the second part of the life-history described above, *i.e.*, the particular alteration and utilisation of the blood-cells as a store of reserve food-material, during the period of trophic inactivity, and the series of successive divisions until the size of the individual is reduced to that of the small vases, has taken place since the whale was wounded. But, on the view under discussion, this must have been the case, because *all* these "resting"-forms, down to the smallest and youngest, contain pigment.

The cumulative effect of the above evidence leaves no doubt in our minds that, as stated above, *Haematophagus* lives normally on the red blood-corpuscles of *Megaptera nodosa*—and possibly, of course, of other, Whalebone Whales as well.

The horny substance of the baleen is so thick that it is doubtful how the parasites obtain their food. It should be remembered, however, that living baleen is softer than the hard, dry material which may be seen in a Museum; and it is not impossible that the parasites may have some means of excavating or penetrating the horny outer layer of the plate in order to obtain access to the vascular papilla within. In this connexion it is of interest to note that Mr. D. G. Lillie alludes, in a letter recently received, to "the distinct wearing away of the shining surface of the baleen plates in patches under parts of the scum," noticed by him when he collected the material.

A possible "external" source of supply may be mentioned. The occurrence of large barnacles on *Megaptera* is a well-known fact. Goodall* mentions that open scars and bleeding wounds (the torn ends of the blood-vessels being clearly seen) were generally present on the specimens he examined. These wounds result from the forcible removal of the embedded barnacles as the whale rubs or scrapes itself against

* *Zoologist*, 1913.

something. As the barnacles occur (among other places) on the snout, jaws and chin of the whale it is not unlikely, we think, that water containing a certain amount of blood is frequently strained through the baleen-plates. The question of the origin of the blood-supply cannot, however, be definitely settled until actual details are forthcoming of the exact relation of the parasite to its host.

A few of the drawings for Pls. I–III were made by Miss M. Rhodes, of the Lister Institute; and for the microphotographs (Text-fig. 1) we are indebted to Dr. D. J. Reid. We desire to thank both very much for their kind assistance.

INDEX.

Anoplophrya, 19.
Atkinson, E. L., 1, 2.
Biflagellates, 2, 4.
Binucleata, 2, 4.
Bodonidae, 2.
caulleryi, Selenidium, 6, 7.
Chilodon, 10.
Ciliata, 7.
Cryptobia, 2, 4.
„ *trematomi*, 2.
Cryptoicus, 4.
Cyclopterus lumpus, 4.
dahlii, Heteromita, 4.
Flagellata, 2.
Folliculina, 9, 10.
Freia, 9.
Gregarinidea, 5.
Gymnostomata, 10.
Haematophagus megapterae, 7.
Haemoflagellates, 3.
Haemosporidia, 12.
Heteromita dahlii, 4.
Heterotricha, 7.
Holotricha, 10.
Humpback whale, 7, 8.
Lillie, D. G., 1, 8, 20 *n*, 21.
Mastigophora, 2.
Megaptera nodosa, 7, 21.
megapterae, Haematophagus, 7.
mesnili, Selenidium, 7.
Monocystid Gregarine, 5.
Myxosporidia, 1.
parvum, Selenidium, 5.
pendulum, „ 6, 7.
Polychaete, 5.
Sabellidae, 5.
Selenidiidae, 5.
Selenidium caulleryi, 6, 7.
„ *mesnili*, 7.
„ *parvum*, 5.
„ *pendulum*, 6, 7.
Sporozoa, 5.
Stentor, 9, 10, 16.
Stentoridae, 7.
Telosporidia, 5.
trematomi, Cryptobia, 2.
Trematomus bernacchii, 2.
Trichomonas, 2.
Trypanoplasma, 2, 3, 4, 5.
„ *ventriculi*, 4.
ventriculi, Trypanoplasma, 4.
Vorticella, 20.
Whalebone whales, 21.

LONDON : PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, DUKE STREET, STAMFORD STREET, S.E., AND GREAT WINDMILL STREET, W.

Office.
22 MAR 1921

PLATE I.

FIGS. 1–4. *Cryptobia trematomi*, n.sp. (× 2,000.)

FIGS. 1–4.—Different appearances shewn by the parasite.

FIGS. 5–12. *Selenidium parvum*, n.sp. (× 900.)

FIGS. 5, 6.—Intracellular forms.

FIGS. 7, 8.—Growing sporonts, free in the lumen of the intestine. In Fig. 7, the longitudinal striations (myonemes) are well shown.

FIGS. 9, 10.—Large forms, ripe (?) sporonts.

FIGS. 11, 12.—Medium-sized forms, encapsuled (see text, p. 6).

FIGS. 13–20. *Haematophagus megapterae*, n. gen., n.sp.

FIG. 13.—Moderately large tubular form. (× 150.)

FIGS. 14–17.—Anterior ends of large forms; to show membranellae and large cilia, pharyngeal depression, basal fibrils, ingested masses of red blood-cells. (× 300.)

FIG. 18.—Longitudinal section of edge of the body, showing the general ciliary covering, basal granules of the cilia, and investing envelope. (× 1,200.)

FIGS. 19, 20.—A small portion of the body in the neighbourhood of the nucleus; in Fig. 19, the micronucleus (*m*) is visible. The macronucleus shows numerous karyosomatic grains. In addition are seen pale masses of blood, in food-vacuoles, digestion being nearly completed and clumps of pigment formed; also, elongated tubes, representing the "skin" of empty, drawn-out food-vacuoles; and various crystalline elements. (× 300.)

H. M. Woodcock & M. Rhodes del.

BRITISH MUSEUM
Z D
NATURAL HISTORY

PLATE II.

Haematophagus megapterae, n. gen., n.sp.

(For magnification, *vide* separate figures.)

Fig. 21, a–e.—Different stages in the aggregation and fusion together of the blood-corpuscles in the food-vacuoles, leading to the formation of homogeneous masses; and the appearance of such a mass when digestion is almost completed, and pigment-grains are produced in close relation with the vacuole. In (a), only some of the included corpuscles are drawn—giving, roughly, an optical section. (× 600.)

Fig. 22.—Transverse section across the body of a large form, in the region of the nucleus. Note the investing envelope and uniform fringe of fine cilia. The karyosomes in the macronucleus have stained intensely. The micronucleus is seen at (*m*). The darker, round bodies in the cytoplasm are small blood-masses. (Stained with iron-haematoxylin; × 600.)

Figs. 23–28.—The small tubular forms. In some cases the parasite is withdrawn well inside its envelope. Note the distinct adoral cilia, never fused into membranellae; the absence of a conspicuous pharynx; the large clear space in the posterior half of the body; and the collection of pigment-granules, often present between the hinder end of the body and the envelope. The small individual of Fig. 27, occupying only about half the envelope, results, most probably, from a recent division, the other daughter-individual having liberated itself from the common investment. (Figs. 23–27, × 300; Fig. 28, × 600.)

Figs. 29, 30.—Large, tubular individuals in an early stage of transformation into the ovoid form. In Fig. 29, the posterior half of the body, containing most of the clumps of pigment, has been cut off; in Fig. 30, not only has a large part of the posterior half been cut off (though there are still some masses of pigment left behind the nucleus), but also the anterior end with the adoral apparatus has been cut off. (Fig. 29, × 150; Fig. 30, × 300.)

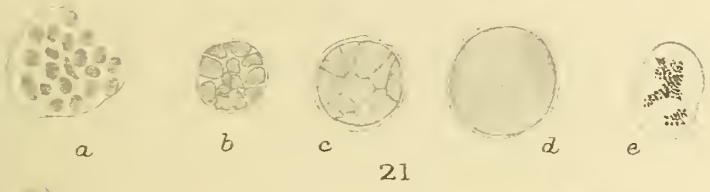
Fig. 31.—Large, ovoid "resting" form, surrounded by its envelope. The parasite still possesses the retracted adoral apparatus and pharynx, but has lost the posterior half of the body with the pigment. The cytoplasm is full of ingested blood, not undergoing digestion in the ordinary manner. (× 300.)

Figs. 32, 33.—Large, ovoid forms, in which the anterior end is in process of being cut off. In Fig. 32, the cytoplasm is coarsely granular, full of reserve food-material (stage 3—see p. 15). The micronucleus (*m.*) is seen at the side of the macronucleus. In Fig. 33 (drawn in outline only), the cytoplasm is in a similar condition. (× 300.)

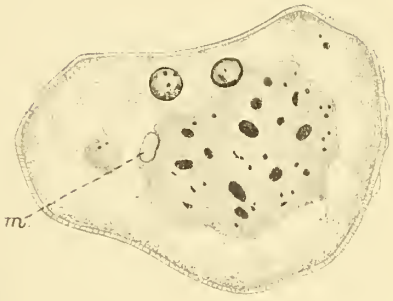
Fig. 34.—Superficial view of a large, "resting," ovoid form, showing the appearance of the striations due to the longitudinal rows of basal granules. (× 300.)

Fig. 35.—An ovoid parasite which has lost its anterior end, but in which the cytoplasm still shows numerous small masses of blood (stage 1). (× 300.)

Fig. 36.—Ovoid form with the cytoplasm in the intermediate condition (stage 2—see p. 15). The body is quite free from pigment, but a few clumps, which have been expelled, are seen inside the investing envelope on the left. The micronucleus (*m.*) is seen. (× 300.)



21



22.

23.

24.

25.

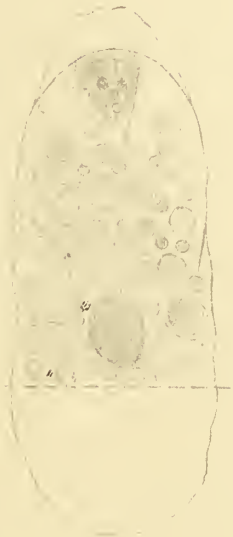
26.

27.

28.

29.

30.

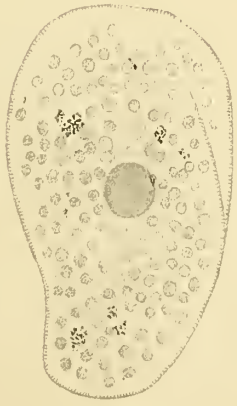


31.

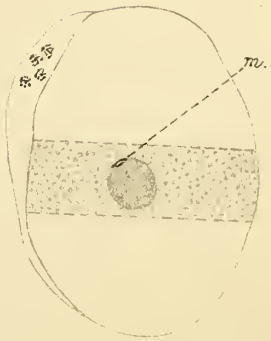
32.

33.

34.



35.



36.

H. M. Woodcock & M. Rhodes del.

Huth, London.

BRITISH MUSEUM
Z D
NATURAL HISTORY

PLATE III.

Haematophagus megapterae, n.gen., n. sp.

(All Figs. × 300, except Fig. 37, × 150; Fig. 60, × 450; and Fig. 63, × 600.)

Fig. 37.—Large, ovoid form undergoing division (transverse binary fission.)

Fig. 38.—Medium-sized form with two macronuclei, but only a single micronucleus (*m.*), resulting from the first division of a large ovoid. Note the pharynx, and the retracted membranellae (?). The reserve food-material is being used up, with the formation of pigment.

Fig. 40.—Similar form, more elongate-ovoid in shape, in which successive nuclear divisions have occurred; 7 macronuclei are present. The basal fibrils, in connection with the pharynx, are well-marked. This and succeeding figs. show the envelope surrounding the parasite.

Figs. 39, 41.—Further binary fission inside the envelope. In Fig. 39 each daughter-individual has a single macronucleus, itself about to divide again; but in Fig. 41, one of the products of division possesses two, the other four macronuclei. The daughter-individuals have developed a pharynx and basal fibrils, though the latter are not prominent.

Figs. 42, 43.—Individuals resulting probably from a second division, as indicated in Fig. 39. In Fig. 43 the micronucleus is visible.

Fig. 44.—A similar form, but multinucleate.

Fig. 45.—Further division. Note how rudimentary is the pharyngeal development.

Fig. 46.—A smaller ovoid form, without pharynx, in which the macronucleus is dividing.

Fig. 47.—Division without redevelopment of the pharynx.

Fig. 48.—A division-couple in which there is only the feeblest indication of the development of the pharynx. Each daughter-individual appears to have partially secreted an independent envelope (seen inside the common investment in the angles between the two parasites).

Fig. 49.—A similar couple in which the common envelope seems to be lacking (or has been divided—cf. pp. 18, 19). The pharynx is slightly more prominent in the two individuals of this pair; and in each a micronucleus (*m.*) is distinctly seen.

Fig. 50.—Superficial view of an elongate form at about the same stage, showing the longitudinal rows of basal granules. The pharynx is clearly indicated.

Figs. 51, 52.—Multinucleate individuals. In Fig. 51 the pharynx is present, but in Fig. 52 it is lacking; in the latter the cytoplasm contains a large crystalline element.

Fig. 53.—A slightly smaller ovoid parasite, uninucleate. (From this stage onwards no pharynx appears to be developed.)

Figs. 54, 55.—Division of such a form. The couple of Fig. 54 are enclosed in a common envelope; in Fig. 55, each daughter-individual appears surrounded by its own investment.

Figs. 56, 57.—The small forms resulting from such division; these are about the smallest "ovoid" forms seen, and represent the end-product of the successive divisions. In Fig. 56 the macronucleus is much elongated and about to divide; in Fig. 57 four macronuclei are present and a clear area is seen, in the hinder part of the cytoplasm; this parasite is most probably about to become a small tubular Ciliate, with a conspicuous clear space.

Fig. 58.—A small tubular Ciliate, which has lost its cilia and ceased its active trophic functions, about to divide, as shown by the macronucleus, elongated in a characteristic manner.

Fig. 59.—The most minute parasite found. This is of the small tubular type, with the clear space, and possesses no fewer than six macronuclei.

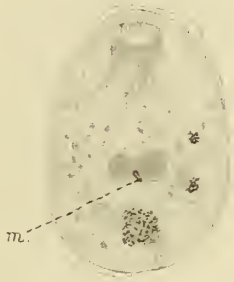
Fig. 60.—Fission of a small tubular Ciliate, inside its investment, the adoral cilia of the original parasite persisting, and the other individual developing a new ciliary zone.

Fig. 61.—A small tubular parasite, inside its tubular envelope, which has lost its cilia and also clear space. It possesses three macronuclei.

Figs. 62–64.—Stages in the binary fission of a corresponding form. In Fig. 62 the macronucleus is dividing. Fig. 63 shows the middle portion of the same parasite, more highly magnified. The chromatin-grains (probably chromosomes) of the micronucleus are in rows on a primitive spindle. In Fig. 64 fission is completed.

Fig. 65.—Multiple transverse fission of a small tubular Ciliate, somewhat larger than most of the small tubular forms. The original adoral cilia persist at the anterior end. Each daughter-individual has a macronucleus and one or more small clumps of pigment-grains.

37.



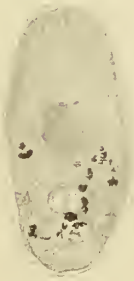
38.

39.

40.

41.

42.

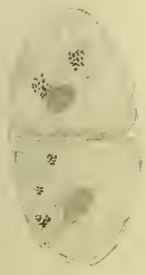


43.

44.

45.

46.



47.

48.

49.

50.

51.

52.

53

54.

55.

56.

57.

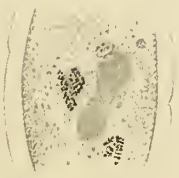
58.

59.

60.

61.

62.



63.

64.

65.

BRITISH MUSEUM
Z D
NATURAL HISTORY

D.72.Aa.
9.
B.

BRITISH MUSEUM (NATURAL HISTORY).

BRITISH ANTARCTIC ("TERRA NOVA") EXPEDITION, 1910.

NATURAL HISTORY REPORT.

ZOOLOGY. VOL. VI, No. 2. Pp. 25–268.

PROTOZOA.

PART II.—FORAMINIFERA.

BY

EDWARD HERON-ALLEN, F.R.S.,

AND

ARTHUR EARLAND, F.R.M.S.

WITH ONE FIGURE IN THE TEXT AND EIGHT PLATES.

B. M.
(N.H.)

LONDON:

PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM.

Sold by Longmans, Green & Co., 39, Paternoster Row, E.C. 4; B. Quaritch, Ltd., 11, Grafton Street, New Bond Street, W. 1, Dulau & Co., Ltd., 34–36, Margaret Street, Cavendish Square, W. 1;
The Oxford University Press, Amen Corner, E.C. 4;
and at the
British Museum (Natural History), Cromwell Road, S.W. 7.

1922.

[*All rights reserved.*]

Price Thirty Shillings.

[*Issued 25th March, 1922.*]

British Museum (Natural History).

"Terra Nova" Report.

This is No. 3. *of* 25 *copies of Zoology, Vol. VI., No.* 2, *Protozoa, Part II., Foraminifera, printed on Special paper.*

4 - MAY 1922

PROTOZOA.

PART II.—FORAMINIFERA.

BY

EDWARD HERON-ALLEN, F.R.S., AND ARTHUR EARLAND, F.R.M.S.

WITH ONE FIGURE IN THE TEXT AND EIGHT PLATES.

CONTENTS.

PAGE

I. Introduction.
(i) Material 26
(ii) Literature 28
(iii) Arctic and Antarctic Types of Foraminifera 30
(iv) Pelagic Foraminifera 34
(v) Classification adopted in this Report 38
(vi) New Species and Varieties Recorded 43

II. List of Stations.
(i) Official—Harmer and Lillie 44
(ii) Geographical—Heron-Allen and Earland 44

III. Description of the Material Examined 45

IV. Species and Varieties Recorded 58

V. Appendix.
A.—Official Station 308 "Off Tierra del Fuego" 230
B.—"Royal Sound, Kerguelen Island" 231
C.—Official Station 42, "Off Rio de Janeiro" 232
D.—Material collected by the "Discovery," 1901–4 233
E.—*Wagnerella borealis*, Meresch. 235
F.—On the Colouration of *Polytrema miniaceum* (Pallas) . . . 247

VI. List of Works Referred to in the Report 236

Index 249

1. INTRODUCTION.

(i) MATERIAL.

SEVEN years have passed since we received from the present Director of the Natural History Museum fifty-four tubes and forty-three jars of varying sizes containing material for examination and report. The work has necessarily been retarded by the War, but has resulted in the recording of more than 650 species and varieties of Foraminifera, forty-six of which are new to Science.

Before the Expedition started we were consulted as to the best methods of collecting, and gladly gave the results of many years' experience, but circumstances appear to have rendered impossible any serious attempt at the collection of foraminiferous material. Apart from the tubes containing the "cores" of soundings (which are of little value from a faunistic point of view), and a few sands from the New Zealand coastal area, the material received consisted principally of sandy débris, evidently the residuum from gatherings of assorted Benthos, and usually "preserved" in formalin, than which no more unsatisfactory medium for the "preservation" of Foraminifera can be imagined.

Now such débris is of course foraminiferous, often rich, but as compared with specially collected material it is extremely difficult to clean, and the results are often fragmentary. Neither time nor trouble was spared in the tedious processes involved, but from the point of view of specialists we can only view the results as a tantalising sketch of the possibilities which would have attended upon an ample supply of properly collected Antarctic material.

The method of preparation employed was to wash the material on graded sieves ranging down to silk gauze of 160 meshes to the linear inch. The material thus retained is referred to in the subsequent report as "Sieves," while the finest mud, passing through the silk gauze, and subsequently separated by means of a filter-paper, is described as "Residues."

It may be noted here that we received no material whatever from five of the "Antarctic Benthos" Stations in the Official List, but we have received facilities for examining some of the Sponges collected at these Stations for sessile species. Also that three jars of material were entirely unlocated and some others bore no Station numbers. These were successfully placed by a comparison of the fauna contained.

Our researches have confronted us with several notable *lacunae*. Conspicuous by their absence, for example, are *Miliolina bicornis*, *Keramosphaera murrayi*, *Hyperammina friabilis*, *Candeina nitida*, *Anomalina ammonoides*, and *Pulvinulina menardii*, all of which have been recorded from similar localities by Chapman or by Pearcey.

A striking feature of our records is the occurrence of arenaceous isomorphs of various forms hitherto known only as porcellanous or hyaline. These have

afforded an opportunity of adumbrating in Section V. of this Introduction a more scientific classification of the Order, especially in regard to the family Lituolidae. The occurrence of such arenaceous isomorphs might have been reasonably anticipated in the Antarctic. The substitution of an adventitious test for one composed of calcium carbonate is no doubt a physiological process due to the low temperature of the animal's environment. It has long been observed that tropical organisms secrete calcium carbonate in great abundance, while benthic and Arctic organisms are characterised by thin, delicate shells, and the experiments of Murray and Irvine proved that the reactions involved in the fixation of $CaCO_3$ were retarded by cold and accelerated by heat. (But see p. 34.)

The fossil or sub-fossil material received from Stations 2, 3, and 6 presents some difficulty. The distinctive nature of the material does not appear to have been recognised when it was obtained from the dredge, and no records were made of its occurrence and relative abundance. The material from these Stations therefore consists of: (1) recent muds and sands easily recognisable as such; (2) more or less disintegrated lumps of the deposit in question; (3) a mixture of the two in which it is not always possible to discriminate between the constituents.

Some of the harder lumps of this deposit have been submitted to various authorities who, as a rule, decline to commit themselves to any definite statement as to its age. The general consensus of opinion is, that the deposit is probably of no great antiquity but represents a recent sea-bottom consolidated by the solution and subsequent re-deposition of $CaCO_3$ in sea water.

Mr. A. W. Waters, on the other hand, after preparation and examination of the material, is inclined to attribute a Tertiary origin to the deposit, on the strength of the occurrence therein of certain Polyzoa (*Cellaria angustiloba*, *Entalophora verticillata*, *Cellepora fossa*) known only as typical Tertiary fossils. He compares the Polyzoan fauna with certain beds in Victoria attributed to the Miocene or Oligocene.

The matter lies outside our province and can only be settled by a further examination of suitable material. We will only observe that if the deposit is of the age suggested, we should have anticipated the occurrence of similarly typical Tertiary Foraminifera. With the exception of a single specimen of *Nummulites variolarius* found at an early stage of our work, anterior to the receipt of Mr. Waters's report, no distinctive fossils occur among the Foraminifera.* The species listed from the hard deposit are to all intents and purposes identical with the recent forms at the same Stations, and any differences are principally due to development, which is usually more noticeable in the fossil than in the recent

* We had rejected this Nummulite without hesitation as due to extraneous circumstances, although we felt that all possible precautions had been adopted in cleaning the material, but in view of Mr. Waters's report its occurrence, if accepted, has obviously a considerable value as evidence in support of his theory.

specimens. One point only appears to us to be definitely proved by the comparatively low percentage of mineral grains, viz.: that the deposit was laid down at a time, and under conditions, when the shore-line was at a far greater distance from the Stations in question than it is to-day.

(ii) LITERATURE.

The multitudinous and world-wide material collected by d'Orbigny prior to 1826, the date of his "Tableau Méthodique," included none from Antarctic regions. Freycinet and Duperrey, from whom he received much material, did not cruise S. of Tasmania.

The literature of our subject may be said to commence with a paper presented by Ehrenberg to the Berlin Academy in 1844, dealing with material collected by Dr. J. Hooker on the cruise of the "Erebus" and "Terror," under Sir James Ross.* A volume of 100 pp. was issued containing instructions to observers and collectors upon this voyage, the data and material collected to be worked out at home after the return of the Expedition.† According to Ehrenberg it was he who caused Humboldt to press for the collection of micro-organisms and to prescribe the methods of collection. We are told that in January 1841, lying becalmed, Ross put over a dredge which brought up rock fragments and "a surprising profusion of animal life." Dr. J. Hooker collected forty packets of soundings from Cape Horn to Victoria Land, and three jars of water which were sent to Germany, and we read that forms collected in 1842 near Victoria Land were still almost fresh when they reached Germany in 1844. Hooker and Ehrenberg both worked on the material, and the conclusions arrived at by Ehrenberg were, shortly, that the relations of organic life were identical at the North and South Poles, that the surface layers ("Pancake ice") were crowded with life, and that the supposition that organisms cannot live below 100 fms. had become untenable.‡

At the time Ehrenberg wrote, only three packets, between 63° and 70° S. (190–270 fms.) had been examined; what became of the rest is not known to us. On p. 188 he records, as found by Hooker, in floating ("Pancake") ice, from 78° 10′ S., 162° W., four Foraminifera; of three of these he gives a nebulous diagnosis on pp. 207–8, the other is simply recorded as "*Spiroloculina*." The three diagnosed forms are: (1) *Grammostomum divergens*, which he subsequently

* C. G. Ehrenberg. "Vorläufige Nachricht über das kleinste Leben im Weltmeer, am Südpol, und in der Meeres Tiefen," Monatsber. Berliner Ak. Wiss., 1844, pp. 182–207.

† The reader is referred to Dr. H. R. Mill's work "The Siege of the South Pole" (London, 1905, pp. 252–326.) The "Erebus" and "Terror" started from England Sept. 30, 1839, and were within the Antarctic Circle (S. of 66° 30′ S. lat.) between Jan. 1 and March 4, 1841, Jan. 1 and March 6, 1842, and March 1 and March 11, 1843. They returned to England in September, 1843.

‡ An abbreviated translation of Ehrenberg's paper was published in Ann. Mag. Nat. Hist. xiv, 1844, pp. 169–181, "On Microscopic Life in the Ocean at the South Pole and at Considerable Depths."

figured (E. 1854, M. xxxv. A. Fig. xxii, 22)* and recorded as "*Guttulina? divergens* and *Grammostomum*, 1844." Sherborn suggests *Bulimina*, and it is probably referable to that genus, of the *B. pupoides* type. Ehrenberg also records the same species (on p. 192) from Gulf Erebus and Terror, 63° 40′ S., 55° W. (270 fms.).† (2) *Rotalia antarctica*, and (3) *R. erebi*. He gives no figures, but from the diagnosis they appear to be starved forms of *R. beccarii* (Linn.). And then came what Dr. Mill calls "the generation of averted interest." No other exploration of importance, and certainly no collection of material took place in Antarctic waters until the voyage of the "Challenger" in 1874, whose "furthest south" was 66° 40′ S., 78° 30′ E., S. of Kerguelen Island. But the "Challenger" made the first systematic series of soundings in the Antarctic, and the statement was made that here the Globigerina ooze (or Red Clay in deeper water) merges into Diatom ooze, and then into terrigenous Blue Mud. (*Cf.* Dr. Harvey Pirie's Map in P. 1913, S.N.A.)

The principal works dealing with the Foraminifera of our areas are, for the New Zealand area, Chapman 1905, G.B. I; 1909, S.N.Z.; and Cushman 1919, R.F.N.Z.; the latter paper being founded merely upon four type-slides, sent to the author by our late friend Mr. R. L. Mestayer, of Wellington, N.Z., containing specimens from the "Poor Knight's" Islands (35° 30′ S., 174° 43′ E.); it therefore lacks the authority of Chapman's papers, which were the outcome of research upon ample material. For the Antarctic area, the works available to the student are Pearcey's paper on the Foraminifera of the Scottish Antarctic Expedition, 1902–4 (P. 1914, S.N.A.), in which he records 242 species and varieties, and Dr. Harvey Pirie's paper on the Deep Sea Deposits (P. 1913, S.N.A.), which, however, records no species other than those listed in Pearcey's memoir. Our friend Mons. E. Fauré-Fremiet has contributed two papers on the French Antarctic Expedition of the "Pourquoi pas?" (F. 1913 and 1914, F.M.A.F.). M. Fauré-Fremiet is an excellent worker, but unfortunately his material must have been very inadequate, for he only records fourteen species. In 1914 Chapman, in the Reports of the Shackleton Expedition (1907–9), contributed two papers, one Geological (C. 1914, E.D.R.S.) on (*a*) a deposit 20 feet above sea-level N. of the Drygalski Glacier, and (*b*) another from the slopes of Mt. Erebus, 160 feet above sea-level; the other, Recent (C. 1914, F.O.R.S.), from soundings in the Ross Sea, in which he records sixty-six species and varieties.

It is obvious that the material submitted to these authors was very inadequate, but we made, originally, a point of giving references to their papers in the synonymies of all species and varieties recorded by us from the far more extensive material submitted to us for examination. The drastic reduction of synonymies

---

* For explanation of the method employed by us, with a view to economy of space, in all our bibliographical references, see p. 236.

† Ehrenberg's figure of *G. divergens*, Pl. xxi, fig. 86, is *Bolivina dilatata*, Rss., a quite different form.

explained on p. 58, necessitated by the present conditions of cost of printing and paper has compelled us to excise this portion of our work, but the papers themselves are no doubt readily accessible to the student.

It remains only to say that, though as we have indicated (*supra*), the gatherings consigned to us might have been much more exhaustive and representative than they are, the material analysed in this Report is by far the most voluminous that has been brought to this country from either New Zealand or the Antarctic regions.

(iii) ARCTIC AND ANTARCTIC TYPES OF FORAMINIFERA.

It is not easy to form any comparison between the foraminiferal fauna listed in our Report and the tables of species from high latitudes published by Brady (B. 1884, F.C., pp. 779–785), because, of the eight Antarctic stations figuring in his list, five are from localities on or adjacent to the Southern extremity of the American continent, and two of the other Stations represent rich insular gatherings round Kerguelen Id. and Heard Id. The remaining list is from "Challenger" Station 150 in the Southern Ocean (52° 4′ S.) in 150 fathoms. This is approximately the latitude of our Stations 11 and 12 (Official Stations Nos. 208–9), and the depth is very similar, but the nature of the Challenger material, which was organic débris from a rocky bottom, yielding only sixteen species of Foraminifera, forbids any direct comparison with the oozes obtained at these two "Terra Nova" Stations. Brady did not list the species derived from the deep water "Challenger" Stations off the Ice Barrier (Stn. 153—1,675 fms., Stn. 155—1,300 fms., Stn. 157—1,950 fms.), all of which would have afforded suitable material for a comparison with our Report.

Murray in the "Summary of Scientific Results of the Voyage of the 'Challenger'" (1895), vol. 1, p. 498, gives a list of forty species of Foraminifera from Station 153. This is probably not exhaustive. It contains many interesting forms, but perhaps the most noticeable point is the absence of *Globigerina pachyderma* (Ehbg.), and the presence of *G. dutertrei*, d'Orb.

Nor is it easy to make any direct comparison with the foraminiferal fauna from Arctic latitudes given in the same table because our list includes many deep-water Stations, whereas 300 fathoms represents the maximum depth in Brady's list. But a comparison of the species in Brady's Arctic and Antarctic lists with our own records yields some noticeable results, in some respects confirming Brady's observations and in others disproving them.

Thus Brady records the following species as Antarctic but absent from the Arctic :—

1. *Articulina funalis*, Brady.
2. ,, ,, var. *inornata*, Brady.

3. *Clavulina communis*, d'Orbigny.
4. *Sagrina raphanus*, Parker and Jones.
5. ,, *dimorpha*, Parker and Jones.

Nos. 1 and 3 are abundant in our Antarctic material, but the others do not occur.

Again Brady comments on the fact that the following forms occur in the Arctic, while no representatives of these genera occur in the Antarctic :—

1. *Verneuilina polystropha* (Reuss).
2. *Bigenerina nodosaria*, d'Orb.
3. *Spiroplecta biformis* (P. & J.).
4. *Polymorphina acuminata* (d'Orb.).
5. ,, *compressa*, d'Orb.
6. *Polymorphina lactea* (W. & J.).
7. ,, *oblonga*, d'Orb.
8. ,, *rotundata* (Born.).
9. *Operculina ammonoides* (Gron.).

But No. 1 appears in our Antarctic list with four other species of *Verneuilina* ; No. 3 with another species, *Spiroplecta annectens* (P. & J.) ; No. 9 occurs, and although only Nos. 5 and 8 are represented in our list of Polymorphinae, our Antarctic species of that genus number eight, as against Brady's five from the Arctic and none from the Antarctic. Possibly the most striking fact in the comparison of the Polymorphinae lies in the entire absence of *P. lactea* (W. & J.) from both Antarctic lists, though it figures at five out of six of the Arctic Stations. It looks therefore as though *P. lactea* may be regarded definitely as absent from the Antarctic. *Operculina ammonoides* (Gron.) occurs at several Antarctic Stations.

Among Brady's other deductions are :—

1. That *Uvigerina* and *Sagrina* replace *Polymorphina* in Southern latitudes. With this we cannot agree for reasons already given.

2. That *Clavulina* (*C. communis*, d'Orb., understood) similarly replaces *Bigenerina*, which appears to be correct.

3. That the porcellanous forms display a more varied development in the South than in the North. In support of this he lists twenty-four porcellanous species, nineteen of which are Antarctic against ten in the Arctic list. There are twenty-six porcellanous forms in our Antarctic list, including several species not common to our own list and Brady's, so the deduction appears to be correct if the Arctic list may be regarded as fairly complete.

4. That the Northern region is much richer in—

(*a*) The Textularian types ;
(*b*) Polymorphinae ;
(*c*) Nonioninae.

As regards (*a*) the deduction is based on a list of twenty-seven Textulariidae, nineteen of which are recorded by Brady as Antarctic and only sixteen as

Arctic. The reasoning is therefore at fault if Brady had "species" in his mind. If however "number of specimens" was intended we may perhaps agree, as, with certain exceptions (*Clavulina communis*, *Cassidulina* (various species), *Bulimina chapmani*, *Ehrenbergina hystrix* var. *glabra*, etc.) the Textulariidae occur very sparingly in our Antarctic material. The genus *Textularia* itself is represented in our list by a single deep-water form, *Textularia concava* var. *heterostoma*, Forn., as against three species in Brady's Antarctic list and two in his Arctic list; and other genera, where represented at all, are usually very rare. But we have some forty-seven species and varieties of Textulariidae on our list, south of the Antarctic Circle, so Brady's conclusion must not be accepted without further evidence. As regards (*b*) we have already stated the reasons for our disagreement with Brady's conclusion.

As regards (*c*) Brady lists eight species of *Nonionina*, all of which figure in the Arctic fauna, but only four of them appear in his Antarctic list, and these are confined to the Patagonian localities and do not figure in the Kerguelen, Heard Island or Southern Ocean material. Our experience is very different, for we have eight species on our Antarctic list and one of them is *Nonionina stelligera*, d'Orb., which is one of the most characteristic Northern forms. It figures in all the Arctic Stations of Brady, but at only one Southern Station, off the Patagonian coast.

Hence we may regard this conclusion of Brady's to be unfounded also.

Brady's tables include fifty-three genera and 189 species, of which forty-four genera, represented by 137 species, occur in the Southern area and forty-one genera, represented by 111 species, occur in the Northern area; thirty-two genera, represented by sixty species, being common to both areas.

Such a large proportion of forms common to Northern and Southern waters might be used as evidence in favour of the theory of bipolarity by a zoologist unfamiliar with the group, but to the rhizopodist the presence or absence of a few particular species would be more convincing evidence than the longest list of other forms. This, for the reason that, apart from those genera and species limited in their distribution by conditions of mean temperature (which form the characteristic shallow water foraminiferal faunas of different latitudes), the mean temperature at all depths below 500 fathoms all over the world does not vary more than a few degrees, and so would constitute no barrier to the gradual migration of Foraminifera from one pole to the other by way of the cold waters of the deep sea. Hence we should be loth to accept the existence of any species or number of species in both Arctic and Antarctic waters as evidence in favour of bipolarity, but should be prepared to regard the absence from either region of a species *known to be peculiarly characteristic of the other region* as definite evidence opposed to the theory.

Brady's list of Arctic Foraminifera contains at least three species peculiar to

Arctic and adjacent seas. They are *Reophax arctica*, Brady, known only from the Arctic, and by a few pauperate specimens from Delos (Sidebottom), *Hippocrepina indivisa*, Parker, known from the Gulf of St. Lawrence, the Arctic seas, and in a starved form from the Moray Firth; *Polystomella arctica*, P. & J., perhaps the most typical and abundant of all Arctic species, a large, strong species which cannot be overlooked and with a Southern limit about the Moray Firth.

None of these three forms have ever been recorded from the Southern area, and but for the occurrence of a single specimen (broken) of *Hippocrepina indivisa* in our own records we should regard their complete absence as more striking than the occurrence of a multitude of other species which have a more or less universal distribution.

It is more difficult to select similar forms from the Southern area, but there are two characteristic Antarctic forms which may be considered, viz.:

(1) *Articulina funalis*, Brady, abundant in the farthest South gatherings. This has been recorded also from shallow water in the tropics, but never, so far as we know, in Northern Seas.

(2) *Ehrenbergina hystrix*, Brady, represented abundantly in the Antarctic by our variety *glabra*, and otherwise known only from deep water in the Pacific.

Practically the only species (so called) which could be invoked as evidence of bipolarity is *Globigerina pachyderma* (Ehbg.). This curiously thick-walled and very characteristic form is the typical *Globigerina* of Arctic deposits. *Pace* Sir John Murray* it is a purely benthic form, its very structure is opposed, in our opinion, to any idea of its existence in the pelagic state. Abundant in the Arctic oozes, it becomes rarer in the North Atlantic, and, save for perhaps an occasional doubtful specimen, such as the records from the Pacific (B. 1884, F.C., p. 777), reaches its southern limit in the Färoe Channel. It does not form a constituent of the bottom oozes of temperate and warm seas, as might be expected if it were either

(1) Pelagic, as stated by Murray, we believe in error.

(2) Benthic, but generally distributed.

Yet *Globigerina pachyderma* (Ehbg.), occurs in the Antarctic as the typical *Globigerina* at all depths.

As we have stated elsewhere in our notes on the two species, the explanation of the occurrence of this Arctic form in Antarctic oozes, and its absence in intermediate deposits, lies in the fact that it is not a true species, but a local variation of *Globigerina dutertrei*, d'Orb., induced by conditions of temperature. The same gradual transition of the one type into the other which we have described in the Antarctic could be traced in the Arctic and temperate seas, and although the records of *G. dutertrei* are singularly few (probably because it is

* J. Murray, "The Ocean" (London, n.d.) 1913, p. 165 and "Pelagic Foraminifera" 1897, Nat. Science, vol. xi, pp. 17–27.

indistinguishable in the superior aspect from *G. bulloides*), it is known to be a pelagic species and is doubtless of world-wide distribution.

The replacement of the comparatively thin-walled Globigerinae of warm seas by thicker-walled types, like *G. dutertrei* and *G. pachyderma*, as one approaches the poles, is a very remarkable fact and at variance with the general rule that organisms secrete calcium carbonate in greater abundance under tropical conditions than under arctic. It might be expected that their arenaceous isomorphs would increase in abundance. But the arenaceous isomorph of *Globigerina* (*Haplophragmium globigeriniforme*) is not more prevalent in the Arctic and Antarctic than elsewhere. *Vide* our previous reference to this subject on p. 27.

Incidentally, the records of *G. pachyderma* in Brady's list (B. 1884, F.C. p. 784) are puzzling in the extreme. He records it at four out of the six Arctic stations but at none of the Antarctic, and in his description of the form (B. 1884, F.C. p. 600) he does not refer to its occurrence at any point south of the Färoe Channel. Yet he, of all men, must have been thoroughly familiar with the type, for he rediscovered the species, which had been described in 1861 and figured in 1873 by Ehrenberg, and then forgotten. The only explanation possible seems to be that some of Brady's assistants who worked out the Antarctic material for him overlooked the extreme "*pachyderma*" type and selected the starved "*dutertrei*" specimens instead. *G. pachyderma* can hardly have been lacking at "Challenger" Station 150.

(iv) PELAGIC FORAMINIFERA.

Eighteen tubes of tow-nettings taken by the Terra Nova were placed in our hands for examination. They covered the whole period of the voyage, four being from Stations in the Atlantic on the outward cruise, five from the seas round the extreme north end of New Zealand, and the remaining nine being spread over the area between the South Island of New Zealand and the Antarctic coast-line. Eight of the stations yielded pelagic Foraminifera, but as three of these were from the warm Atlantic, and four from warm New Zealand seas, they present little interest for this report. The eighth and most southerly tow-netting in which pelagic Foraminifera were detected was from Station (Off.) 167.

Unfortunately, all the material had been preserved in formalin, than which as we have observed (*ante*), no more unsatisfactory medium for pelagic Foraminifera can be conceived. As a result all trace of the thin calcareous shells had vanished and nothing was left but the protoplasmic bodies of the animals held together by the delicate chitinous lining of the original shell. Identification of species has therefore been confined to those forms in which the shape and method of arrangement of the chambers is sufficiently distinctive for recognition. Probably pelagic forms had been present in most of the other gatherings, but had become too much destroyed for recognition. The incident is the more unfortunate as

information on the distribution of pelagic species in the Antarctic seas is much wanted and particularly in respect of *Globigerina pachyderma* (Ehbg.).

The question whether *Globigerina pachyderma* exists in the pelagic state remains still open to doubt. The species was first described by Ehrenberg from 1,000 fathoms in Davis Straits. It was recorded in the material from the Austrian Arctic Expedition of 1872–4, and the British Arctic Expedition 1875–6. The "Knight Errant" dredged it in the cold area of the Färoe Channel in 1880. All these records are of benthic specimens. Brady, in his report on the Foraminifera of the cruise of the "Knight Errant" (B. 1882, F.K.E., p. 717) states definitely that no specimens occur in any of the surface mountings, and remarks "that the small northern variety of *Globigerina*, which is tolerably abundant as a bottom species in three out of the five localities, should not be an equally prominent constituent of the surface fauna is a noteworthy fact."

In the "Challenger" Report (B. 1884, F.C., p. xiii) Brady went even farther. Commenting on the bottom distribution of *G. pachyderma* in the Färoe Channel, abundant in the "cold" area and more sparingly at one station in the "warm" area, he states that "in the tow-net gatherings *G. bulloides* was equally plentiful over the cold and warm areas; but neither there, nor hitherto in any other region, has *G. pachyderma* been met with at the surface." And in the light of his examination of the tow-net collections of the "Challenger," his subsequent remark under the description of the species (*op. cit.*, p. 600), "I have never succeeded in finding it in the tow-net gatherings, although small examples of the typical *G. bulloides* are not uncommon amongst the surface organisms of the same areas," crystallises his views on the subject.

Murray and Renard in their Report on the Deep-Sea Deposits of the "Challenger," 1891, p. 214, give a list of 21 pelagic Foraminifera. It differs in several respects from the list of 20 species given by Brady (B. 1884, F.C., p. x), two species, *Chilostomella ovoidea*, Reuss, and *Pulvinulina patagonica* (d'Orb.), which appear in Brady's list, disappearing and being replaced by three additional species of *Globigerina*, viz.: *G. digitata*, Brady, *G. cretacea*, d'Orb., and *G. dutertrei*, d'Orb. There is still no suggestion that *G. pachyderma* (Ehbg.), exists in the pelagic state.

In 1897 Murray published his paper on Pelagic Foraminifera in which he extends the list of species to 26. *Pulvinulina patagonica* reappears, and four additional species of *Globigerina*, including *G. pachyderma*. Murray also states that "in the Arctic and Antarctic regions *Globigerina dutertrei* and *G. pachyderma*, together with very minute specimens of *Globigerina bulloides*, appear to be the only forms present in the surface waters."

Just before his death, Murray published his little book on Oceanography, "The Ocean" (London, n.d., [1913]). On page 165, writing of pelagic Foraminifera, he states: "Towards the equator more than 20 species may be found

in the tow-nets, but they gradually disappear as we proceed into colder water towards the poles; only one species of *Globigerina* (*G. pachyderma*) is found living in the Arctic surface waters and another species (*G. dutertrei*) in the Antarctic waters. Some authors regard these two species as identical."

With the purport of Murray's last sentence we are in agreement (*Vide sub G. dutertrei* and *G. pachyderma* in our Report). But with the earlier statements we must disagree. No evidence is produced in support of the statement that *G. pachyderma* is pelagic, but Pearcey and ourselves have demonstrated the existence of both forms in the Antarctic oozes. The whole structure of *G. pachyderma* is so dissimilar from the other recognised pelagic species in its massive walls, minute oral aperture and absence of external spines that we must decline to accept Murray's conclusions until definite evidence of its occurrence in tow-nettings is produced. For this reason we regret that the few "Terra Nova" gatherings submitted to us afford insufficient evidence even for the rejection of Murray's record.

The "Terra Nova" tow-nettings examined yielded the following results:—

Station No. 5, June 21, 1910, 38° 37′ N., 14° 42′ W. Surface. Full speed tow-net, 12.30 to 1.15 p.m. Species identified: *Globigerina aequilateralis*, Brady, *G. bulloides*, d'Orb., *G. conglobata*, Brady, *Orbulina universa*, d'Orb.

Station No. 7, June 23, 1910. Flora Light, Madeira, N. 60°, E. 7 miles. Surface. Full speed tow-net, 3.15–3.45 p.m. Species identified: *Globigerina bulloides*, d'Orb., and *Orbulina universa*, d'Orb.

Station 34, July 14, 1910. 2° 38′ N., 21° 16′ W. Depth, 1 metre. Full speed tow-net, 2–3 p.m. Species identified: *Globigerina aequilateralis*, Brady, *G. bulloides*, d'Orb., *G. conglobata*, Brady, *G. sacculifera*, Brady, *Pulvinulina menardii* (d'Orb.), *P. canariensis* (d'Orb.).

Station 115, August 16, 1911. 34° 32′ S. 172° 20′ E. Surface. Full speed tow-net, 3–5 p.m. Species identified: *Globigerina aequilateralis*, Brady, *G. sacculifera*, Brady, *Pulvinulina crassa* (d'Orb.), and two minute specimens of *Haplophragmium canariense* (d'Orb.), recognisable with certainty owing to the agglutinate tests which had not been acted on by the formalin and had preserved their ferruginous tint. These are clearly benthic specimens derived either from wave action if the tow-net was over shallow water (no depth recorded for this Station, which was in the neighbourhood of land), or from the washing of dredged material just before the tow-net was used. Such accidental occurrences are, in our experience, frequent in tow-nettings.

Station 123, August 19, 1911. Between North Cape and Doubtless Bay, New Zealand. Surface. Full speed tow-net, 11 a.m.–4 p.m. Species identified: *Globigerina bulloides*, d'Orb., *G. dutertrei*, d'Orb., *Orbulina universa*, d'Orb. *Pulvinulina canariensis* (d'Orb.); also two small benthic specimens, *Pulvinulina*

or *Discorbina* sp. (?) (decalcified and unidentifiable) and *Textularia conica*, d'Orb., undecalcified and distinctive. Their presence is doubtless due to one of the reasons already given, probably wave-action.

Station 124, August 23, 1911. Between North Cape and Doubtless Bay, New Zealand. Surface. Full speed tow-net, 9 a.m.–1 p.m. Species identified: *Globigerina bulloides*, d'Orb., *Orbulina universa*, d'Orb., *Pulvinulina crassa* (d'Orb.), and one small benthic specimen of *Haplophragmium canariense* (d'Orb.).

Station 167, December 7, 1910, 61° 22′ S. 179° 56′ W. Surface. Full speed tow-net, 4 p.m.

This was the most southerly gathering submitted to us in which we detected pelagic Foraminifera. It was essentially a diatomaceous gathering, but the following species were identified: *Globigerina aequilateralis*, Brady, *G. bulloides*, d'Orb., *G. dutertrei*, d'Orb.

Station 206, December 16, 1911, 45° 25′ S., 172° 28′ E. Surface. Full speed tow-net, 9 a.m.–1 p.m. Species identified: *Globigerina bulloides*, d'Orb., *G. dutertrei*, d'Orb., *Hastigerina pelagica*, d'Orb.

Besides the above, gatherings were examined without result as regards pelagic Foraminifera from Stations 30, 102, 137, 180, 186, 207, 217, 267, 313, 344. In view of the preservative employed and the consequent decalcification of the tests, the absence of pelagic Foraminifera at these stations must not be regarded as conclusive.

In addition to the "Terra Nova" material we received nineteen tubes of tow-nettings taken by Scott in his previous voyage on the "Discovery," and properly preserved in spirit. These were all taken in the extreme South, and though examined with interest, yielded no pelagic Foraminifera. This was not unexpected, as they were taken in the immediate neighbourhood of land and under circumstances in which one would hardly expect to find pelagic Foraminifera, even under favourable climatic conditions. They proved to be diatomaceous gatherings principally, although some of the tubes contained almost pure gatherings of Peridiniaceae.

The "Discovery" material came from the following localities—no station numbers furnished:—

Jan. 9, 1902. Robertson Bay.
Jan. 11, 1902. Ross Sea.
Jan. 25, 1902. Barrier of Ross.
Feb. 20, 1902. Winter Harbour.
June 10, 1902. ,, ,,
Jan. 31, 1903. ,, ,,
March 22, 1903. ,, ,,
June 1, 1903. Winter Quarters, No. 8 hole, 10 metres.

Nov. 2,	1903.	Winter Quarters. No. 12 hole, 10 fathoms.
Dec. 14,	1903.	Winter Harbour, Hut Point.
Jan. 1,	1904.	,, ,,
Jan. 12,	1904.	,, ,, Hut Point.
Jan. 31,	1904.	,, ,, ,, ,,
Feb. 18,	1904.	Coaling Harbour, McMurdo Strait.
Feb. 19,	1904.	Erebus Bay.
Feb. 22,	1904.	North of Wood Bay.
Feb. 23,	1904.	S.E. of Foulman Island.
Feb. 24,	1904.	Possession Islands.
Feb. 25,	1904.	Cape Adare—Cape North.

(v.) CLASSIFICATION ADOPTED IN THIS REPORT.

In our recent paper upon *Verneuilina polystropha* (H.A. and E. 1920, V.P., p. 177) we took occasion, in agreement with Bütschli and others, to say: "It seems to us that the various systems of classification which have successively been suggested, and accepted, are more or less artificial and unscientific. Taking a single example, it seems to us that the whole of the Lituolidae should be redistributed among their hyaline and porcellanous isomorphs." We avail ourselves of the opportunity afforded us by the publication of this Report, comprising as it does between six and seven hundred recognised species and varieties, and, in addition, by the fact that we have found and described arenaceous isomorphs of several hyaline species which have not, so far as we know, been recorded as exhibiting isomorphism, to express our views more fully. We do not think the time has yet arrived to abandon the generally accepted, if artificial, system of Brady, which, with some modifications, is followed in this Report. But we have endeavoured to clear the way towards a proper zoological allocation of the Lituolidae by refraining wherever possible from the creation of new arenaceous species, and retaining our new arenaceous forms in the genera to which they naturally belong, treating them as mere variations of an existing calcareous species and always under the varietal name "var. *arenacea*." We have also supplemented this step by liberal references to previously-recorded isomorphic species throughout the Report, but it must not be assumed that these references are in any way complete or even include a majority of the instances of isomorphism which could be found in the literature of the Group.

To explain fully the position, a brief résumé of the history of the Lituolidae seems necessary. Until 1862 no intensive attention had been paid to the arenaceous Foraminifera as such, and it was not until that year that many species which had been included by authors, from d'Orbigny onwards, among the so-called Perforata, were removed from the positions assigned to them and included in the

new family to which Carpenter, Parker and Jones in their "Introduction" (C., P. and J., 1862, I.S.F., p. 140) gave the name of Lituolida. Their explanation of the matter is as follows:—

The family Lituolida "is distinguished from all other types of Foraminifera by this circumstance—that whereas we find, both in the porcellanous and in the vitreous series, that the individuals of particular genera occasionally exhibit an arenaceous incrustation, this is simply an addition to the calcareous shells proper to their respective types, and is not a substitute for it—whilst in these arenaceous types the investment of the body, although presenting the regular conformation of a calcareous shell, is really a 'test' composed of an aggregation of particles obtained from external sources, the organic cement by which these particles are united being all that is furnished by the animal."

The innovation was by no means accepted without reserve by the workers upon the group. Brady, in his preliminary paper upon the Reticularian Rhizopods of the "Challenger" Expedition (B. 1879, etc., R.R.C., p. 23) reviews the situation, and, after stating the position taken up by Carpenter, Parker and Jones, goes on to say:—"Professor Reuss, writing about the same time, whilst admitting the difficulties of the position, proposes to divide the somewhat unwieldy group included in the genus *Lituola* of English systematists; and, as a matter of convenience, there was even then, no doubt, much to be said in favour of his view. In his latest work, published after his death* he divides the family Lituolidea of the 'Introduction' into four genera. . . . It will, however, become manifest as we proceed, that neither of these schemes are any longer applicable to the purpose for which they were devised, and the more recent suggestions of Professor Zittel (Z. 1876, H.P.) and Professor Rupert Jones† scarcely satisfy the exigencies of the present position."

On p. 28 he elaborates these observations in a passage too long to quote, but which is very germane to the question we are discussing.

The first real note of alarm was sounded by Bütschli in 1880 in Bronn's "Klassen und Ordnungen des Thier-reichs." (Vol. I, Protozoa, Leipzig, 1880, p. 193), where he says:—

"We assemble here a series of sandy-shelled Rhizopods, to some extent very incompletely understood, mostly monothalamous, but also at times of polythalamous construction. The assemblage (or association) of these forms is quite provisional, and depends upon, or results only from, the fact that up till now it does not appear possible to arrange them naturally in any other way, and we share the opinions frequently pronounced and expressed by others, that

---

* In Geinitz. Das Elbthalgebirge in Sachsen. Palaeont. vol. xx. Pt. 1. 1871–5. p. 119.

† Monthly Micr. Journ., Feb., 1876. p. 89.

Carpenter's group of sandy-shelled forms, the family Lituolidae, cannot be upheld and maintained. It will therefore form the task of the future to establish the kindred relationships of the forms belonging to this group, namely, their ascription to Imperforata or Perforata, in a manner more precisely isolated."

And in his systematic arrangement he adumbrates his departure (or reversion) in such entries as (*e.g.*) "Gruppe, Miliolida, Carpenter, emend. Bütschli (Miliolida, Carpenter, 1862 + pars. Lituolidarum, Carpenter). So, in his list, *Ammodiscus* follows *Cornuspira* (p. 189); *Cyclammina* follows *Polystomella striato-punctata* (p. 212); *Hormosina*, *Haplostiche* and *Reophax* are placed among the Lagenidae; whilst *Psammosphaera*, *Storthosphaera*, *Thurammina* and *Sorosphaera* follow after *Globigerina*, and so on.

The position of *Trochammina*, with its relatively smooth shell, has always raised a question in the minds of students of this matter, and in 1880 Bütschli, in discussing the genus, amplifies his head-note as follows:—

"As is well known, the sandy-shelled Rhizopods were collected into only three genera by Parker, Jones and Carpenter, and placed together in the family of the Lituolidae among the Imperforata. Of these three genera *Valvulina* has established itself as certainly belonging to the Perforata in proximity to *Bulimina*; the genus Lituola has hereinbefore been commented upon. The genus Trochammina, on the contrary, embraces a great number of mono- and poly-thalamous forms, remarkably diversified in their configuration-relationships, which were only connected together on account of the finer nature of their shell-wall. These construct themselves by the putting together of fine sand-grains, which are so closely built together that the outer surface of the shell always appears smooth and sometimes indeed as if polished; the inner surface is also smooth and is never furnished with labyrinthic outgrowths. Brady has already split up this protean genus into sub-genera, *Ammodiscus*, *Trochammina*, *Hormosina*, and *Webbina*; we think that, as has already been done by von Zittel, these separated so-called sub-genera should be connected with those calcareous forms to which by their construction they most nearly approach. There remains only the so-called sub-genus *Trochammina* (since *Hormosina* will be commented upon as annexed to *Nodosaria*). These comprehensive polythalamous, rotaloid, trochoid or involute nautiloid, in their construction at times come so close to the calcareous Rotalinae, or Nonioninae, and at times to *Pullenia* and *Globigerina* and *Haplophragmium* that we are much inclined to place them among these. Since we, as yet, possess no agreed knowledge on these forms, we think that we should merely refer to their relationships, and hope that future researches upon the placing of these forms will soon be pronounced upon. It seems probable that the genus *Trochammina* might best be entirely separated."

Finally, under the heading "Arenaceous Rotalinae" (p. 207), Bütschli

observes again, "a number of the arenaceous forms, generally included in the genus *Trochammina*, should apparently be placed among the Rotalinae." *

The next serious attempt to redistribute the Lituolidae was made by Neumayr in 1887 † when he discussed previous systems of classification and the relationships of arenaceous and calcareous Foraminifera, giving a table in which he separates the Astrorhizidae properly so called, and divides all the other genera into the arenaceous and calcareous development-stages (*Entwicklungsstufe*) of four "types"—the *Cornuspira* type, the *Textularia* type, the *Lituolida* type, and the *Fusulinida* type—with the latter of which the present Report is not concerned.

This Paper he subsequently elaborated and revised in his great work "Die Stämme des Thierreiches" (Vienna and Prague, 1889, Vol. i., pp. 158–206) in which he repeats his "Tabelle." We need not analyse this lengthy treatise; it suffices to say that he makes a bold and intelligent attempt to carry out the views of Bütschli. His preliminary suggestion, however, may be cited. He disposes certain leading genera as follows:—

Arenaceous Series.	Calcareous Series.
Ammodiscus.	*Spirillina, Cornuspira.*
Webbina.	*Nubecularia.*
Nodosinella.	*Nodosaria.*
Reophax, Haplostiche.	*Nodosaria, Dentalina, Lagena.*
Haplophragmium, Trochammina, Endothyra.	*Marginulina, Cristellaria, Nonionina, Sphaeroidina, Globigerina, Rotalia.*
Cystammina.	*Allomorphina.*

Not the last word on the main issue, but the most important, and the last with which we shall introduce our classification, was uttered by Eimer and Fickert in 1899.‡ After giving Brady's definition of the family (B. 1884, F.C., p. 65) they go on to say:—"By this separation of otherwise similar arenaceous forms from their calcareous relations, Brady retrogrades into error. To employ an isolated and, indeed, quite unessential (or accidental) characteristic as the

* It may be observed in this place that the student, in considering this question of arenaceous isomorphs, cannot afford to overlook the series of papers by Josef Grzybowski, which record and figure a very large number of these, under *Reophax, Haplophragmium, Trochammina, Cyclammina, Sorosphaera*, but which are unfortunately written in Polish, which tantalises the average British worker, so far as his text is concerned. The most significant are "Otwornice czerwonych ilow z Wadowic" (Cracow, 1896), "Otwornice pokladow naftonosnych okolicy Krosna" (Cracow, 1897), "Otwornice warstw Inoceramowych okolicy Gorlic" (Cracow, 1906.) See our "References," G., 1901, O.W.I., p. 240.

† M. Neumayr, "Die natürlichen Verwandschaftsverhältnisse der schalentragenden Foraminiferen," Sitzb., K. Ak. Wiss. Wien, vol. xcv, 1887, pt. i, pp. 156–186.

‡ G. H. T. Eimer and C. Fickert, "Die Artbildung und Verwandschaft bei den Foraminiferen. Entwurf einer natürlichen Eintheilung derselben," Zeitschr. wiss. Zool., vol. lxv, pt. 4, pp. 527–636, figs.

distinguishing feature of a Family, moreover so as to separate a near relation from near relation, brings him into direct antagonism with the requirements of a natural system."* ·

To quote satisfactorily the main contentions of this voluminous study would occupy too much space; it must be sufficient to say that the authors review all previous systems of classification, with due regard to that of Neumayr, with whom, however, they do not altogether agree. The whole work must be considered by the student.

We should also refer to the work of M. E. Fauré-Fremiet, whose output of work upon the Foraminifera is highly significant but regrettably small. In discussing this question, to the study of which he has been led by considerations of pure Biology, he observed in 1910 †

(p. 410.) "On voit qu'une telle classification est fondée uniquement sur l'aspect extérieur de ces organismes. Il m'a semblé qu'elle était peu logique, parce qu'elle ne tenait pas compte de particularités intérieures capables *d'expliquer* ces différentes formes."

(p. 412.) "Dans ce dernier groupe (Lituolides) . . . j'aurai l'occasion de montrer une autre fois, que la forme charactéristique du test arénacé de chaque genre et de chaque espèce est expliquée précisément par la forme des loges chitineuses, laquelle est en rapport, inconnu aujourd'hui, avec le métabolisme propre à la matière vivante de cette espece."

In his view, whether a Rhizopod constructs an arenaceous or a calcareous test depends upon the action of the Mitochondria in the fixation of iron or calcium salts;‡ and in a further paper, published in the same year,§ he states his position as follows:—

"En résumé, on peut admettre que la différence la plus importante qui existe entre les Foraminifères arénacés et les Foraminifères calcaires, est moins d'ordre morphologique que d'ordre physiologique, et que ce soit le métabolisme particulier à chacun de ces formes qui, en réglant la proportion du fer et du

---

* A letter from C. Schlumberger lies before us as we write, dated March 3, 1895, and discussing this matter. In it he says "Nous avons fait de quelques-unes de ces organismes (arénacées) des genres particuliers mais je pense que l'Auteur de toute chose doit bien s'amuser de nos petites distinctions. Je ne veux pas dire que certaines types arénacés ne soient pas des genres spéciaux, c'est incontestable, mais je vois qu'en cherchant bien on trouvera qu'il y a peu de nos genres porcellanés ou perforés qui n'aient leur representant parmi les arénacés et, malgré tout le respect que j'ai pour le savoir de mon excellent ami Brady, je trouve que son genre *Haplophragmium* est une salade de formes dans laquelle on a fourré tout ce que l'on ne savait ou placer."

† Révision des Foraminifères arénacés," Bull. Mus. Hist. Nat. Paris, 1910, No. 7, pp. 410, 412.

‡ Le rôle des mitochondries dans l'élimination de fer chez les Rhizopodes arénacés," C. rend. Soc. Biol., Paris, vol. lxx, 1911, p. 119.

§ "La constitution du test chez les Foraminifères arénacés," Bull. Inst. Océan. Monaco, Sept. 8, 1911, No. 216.

calcium dans les carbonates élaborés, détermine la structure arénacée ou non arénacée du test."

In conclusion we can only state that we are in agreement with the main conclusions arrived at, and in the following Report have endeavoured to give effect to them without abandoning Brady's system. The occurrence in the "Terra Nova" material of new arenaceous isomorphs of several calcareous forms has provided a suitable opportunity for the expression of our own views on the subject.

(vi.) NEW SPECIES AND VARIETIES RECORDED IN THIS REPORT.

Miliolina auberiana, var. *arenacea*.
,, *calcarata*.
Sigmoilina umbonata.
Ophthalmidium margaritiferum.
Dendronina arborescens.
,, ,, var. *antarctica*.
,, *limosa*.
,, ,, var. *humilis*.
Hyperammina elongata, var. *tenuissima*.
,, *novae-zealandiae* (nom. nov.).
Marsipella chapmani (nom. nov.).
Trochammina moniliformis.
Bifarina porrecta, var. *arenacea*.
Bolivina punctata, var. *arenacea*.
,, *inflata*, var. *arenacea*.
,, *variabilis*, var. *arenacea*.
,, *tortuosa*, var. *arenacea*.
,, *textilarioides*, var. *arenacea*.
Bulimina chapmani.
Gaudryina ferruginea.
Cassidulina laevigata, var. *tumida*.
,, *subglobosa*, var. *tuberculata*.
Ehrenbergina hystrix, var. *glabra*.
Verneuilina turris.
Lagena auriculata, var. *quadri-auriculata*.
,, *bicarinata*, var. *spinigera*.
,, ,, var. *villosa*.
,, *clavulus*.
,, *danica*, var. *pendulum*.

Lagena globosa, var. *lineato-punctata*.
„ *orbignyana*, var. *baccata*.
„ *scarabaeus*.
„ *scottii*.
„ *squamoso-sulcata*.
„ *stelligera*, var. *nelsoni*.
Frondicularia scottii.
Nodosaria pellita.
Globigerina cretacea, var. *eggeri*.
Discorbina calcarata.
„ *disparilis*.
„ *harmeri*.
„ *wilsoni*.
Truncatulina lobatula, var. *arenacea*.
„ *tenuimargo*, var. *alto-camerata*.
Rotalia soldanii, var. *arenacea*.
Nonionina turgida, var. *arenacea*.

II. LIST OF STATIONS (Harmer and Lillie).

LIST OF MATERIAL (H.-A. and E.).

It has been found impossible in the case of the soundings and other samples containing Foraminifera to depend upon, or adhere to, the Station numbers as given in the Official List, or to their sequence. The depths given in the List are trawl and net depths, or (frequently) the Station numbers merely record the capture of birds. Again, in many instances the sounding has been made at a considerable distance from the spot indicated by the number in the list, the true position being given on the labels attached to the material as it reached us. Where this has occurred we have given the official number and locality, but our own consecutive number refers to the true position as indicated by the label, which we have appended after the official locality. Where the label locality is within a few seconds of the Station locality we have retained the latter, but have given the depth as indicated by the label. To obviate the confusion which would arise from the reiteration of Station numbers which have little or no bearing upon the samples, or cover a variety of soundings (as in the series labelled "Near 194–5") and are far from geographically consecutive, we have adopted a series of consecutive numbers running strictly from North to South. A glance at the following Table will make this quite clear.

OFFICIAL LIST OF STATIONS, IN ORDER, AND CORRESPONDING NUMBERS (H.-A. and E.), AS ADOPTED IN THIS REPORT.

Official.	H.-A. & E.	Official.	H.-A. & E.	Official.	H.-A. & E.
Débris of Polyzoa	1	194/5 C	29	260	15
E. Coast of N.Z.	7	,, D	30	262	16
90	2	,, E	31	265	17
91	3	,, F	32	270	36
96	6	,, G	33	289	39
134	5	,, H	34	291	40
144	4	,, I	35	308	56
171	18	208	10	314	54
173/4A	19	209	11	331	48
,, B	20	215	14	333	51
180	22	218	37	335	49
184	23	220	38	338	50
184 (near) ..	24	221	43	339	47
188 A	41	222	44	340	45
188 B, C	42	227	21	342	52
193	25	241	12	348	53
194	26	242	8	355	55
194/5 A	27	244	9	356	46
,, B	28	253	13		

III. DESCRIPTION OF THE MATERIAL EXAMINED.

No. 1.—No Station number. [Label—August, 1911. Débris of Polyzoa, etc., brought up on sounding lead off Three Kings Is., New Zealand, 90–120 fms.]

Material.—Coarse débris of Polyzoa and shell-sand with much *Polytrema*. Foraminifera abundant, but mostly dead and waterworn. Notable species:—*Miliolina bucculenta, Lingulina carinata, Spirillina novae-zealandiae, Pulvinulina concentrica, Gypsina globulus.*

No. 2.—Station 90. July 25, 1911. From Summit of Great King, Three Kings Is., S. 14° W., 8 miles, 100 fms.

Material.—Three samples, 90, 90A, 90B.

Sample 90, in spirit, stones encrusted with sessile organisms, coral rock fragments and coarse sand. Foraminifera plentiful, many sessile forms.

Sample 90A, in formalin, shell débris, fragmentary sponges and Polyzoa, sand. Foraminifera not abundant, but varied and in good condition. *Polytrema*

miniaceum and var. *alba* were abundant in both samples 90 and 90A, and yielded much information as to the life-history of the genus.

Sample 90B, dry, white sand consisting of Polyzoan débris and Foraminifera with a few rock-fragments constructed of similar material agglutinated and defying disintegration. Apparently a fossil or sub-fossil deposit, but presenting, so far as the Foraminifera are concerned, a fauna nearly identical with the recent species from this locality.

Notable species:—*Nubecularia decorata, N. tubulosa, Articulina funalis, Dendronina arborescens, Psammosphaera rustica, Marsipella chapmani, Ammodiscus shoneanus, Seabrookia pellucida, Lingulina carinata, Frondicularia scottii, F. spathulata. Residues*, immature Foraminifera, foraminiferal and other débris, some mineral grains, abundant and varied sponge-spicules and many Tunicate-spicules, but only a few diatoms.

No. 3.—Station 91. July 26, 1911. From summit of Great King, Three Kings Is., S. 10° W., 25 miles, 300 fms.

Material.—Two samples, 91, 91A.

Sample 91, in spirit, stones, corals and sand with Polyzoan and sponge débris and flocculent organic matter, very difficult to wash. *Sieves*:—A felt of Polyzoan and sponge-fragments mixed with Foraminifera and sand. Sample 91A, dry, was similar to sample 90B.

Notable species:—*Psammosphaera rustica, Thurammina papillata*, var. *haeusleri, Discorbina lingulata*, var. *unguiculata, Anomalina polymorpha.*

Residues contained abundant sponge-spicules, diatoms, immature and broken Foraminifera, with many calcareous and mineral fragments.

No. 4.—Station 144. Sept. 13, 1911. From Cape Maria van Diemen, W. by S., 7 miles, 35–40 fms.

Material.—Organic débris and sand. Very difficult to clean and yielding little of interest except *Fischerina helix. Residues* largely sponge-spicules and mineral grains in about equal proportions. Many immature and broken Foraminifera, diatoms and much flocculent organic débris.

No. 5.—Station 134. August 31, 1911. Spirits Bay, near North Cape, New Zealand, 11–20 fms.

Material.—Three samples, 134, 134A, 134B.

Sample 134, in spirit, shell-fragments and a little sand.

Sample 134A, in spirit, Molluscan and Polyzoan débris with mud.

Sample 134B, in spirit, fragmentary Ophiurids and other organic débris. The material was not rich, but yielded many shallow-water forms, including *Gypsina globulus* and *G. vesicularis*, both abundant and well-developed, *Spirillina novae-zealandiae* and *S. decorata* in great variety, a hispid specimen of *Polymorphina oblonga* and one of the three specimens of *Cymbalopora bulloides* obtained

from the "Terra Nova" material. *Residues* largely sponge-spicules, but immature Foraminifera were present in some numbers and diatoms in lesser proportion. Much angular mineral matter.

No. 6. Station 96. August 3, 1911. 7 miles E. of North Cape, New Zealand, 70 fms.

Material.—Five samples, 96, 96A, 96B, 96C, 96D.

Sample 96, in spirit, Molluscan and sponge-débris. Foraminifera infrequent but varied.

Sample 96A, in spirit, coarse shell-sand, Polyzoan débris, angular sand. Foraminifera varied and in fine condition, but not abundant. Many of the shells encrusted with the diatom *Navicula* (*Cocconeis*) *glacialis*, Cleve, a species common to both Arctic and Antarctic material.

Sample 96B, dry, several lumps of a white-grey limestone of organic origin, similar in appearance and origin to samples 91A and 90B.

Sample 96C, in spirit and formalin, organic débris of every kind, including many large specimens of *Polytrema*, and a little mud.

Sample 96D, in formalin, fragmentary animal remains with some muddy sand and much flocculent organic matter, very difficult to clean. Sieves yielded a few large Foraminifera and abundant and varied smaller forms.

Owing to the considerable quantity of material received it was possible to work out the fauna of this Station very completely. It yielded a very large number of species, including several new to science, also many of great rarity and interest. Notable species:—*Cornuspira diffusa*, *Iridia diaphana*, *Dendronina arborescens*, *D. limosa*, *Hyperammina novae-zealandiae*, *Jaculella acuta*, *Reophax spiculifera*, *R. euneta*, *Nouria polymorphinoides*, *Hormosina globulifera*, *Hastigerina pelagica*, *Anomalina coronata*, *Carpenteria proteiformis*. *Residues*:—Sponge-spicules, immature and broken Foraminifera and angular mineral grains. The residues of the fossil sample 96B (as with the other fossil samples) were very scanty, almost entirely calcareous débris and immature Foraminifera, with hardly any siliceous organisms or mineral grains. These facts point to a change in the conditions under which the deposits were laid down as compared with existing conditions, although the Foraminiferal faunas are largely identical.

No. 7. No Station number. [Label:—Sounding samples off the East Coast of New Zealand, Oct., 1911.]

Material.—Soundings in formalin. No details of depth or locality. Differentiated into Samples A and B.

Sample A.—Two tubes of greenish-grey sandy mud, dried light grey and weighed about $\frac{1}{2}$ ounce. Broke down readily in water. *Sieves* contained *Globigerina*, pumice and angular minerals. Notable species:—*Bulimina rostrata*. *Residues*, angular minerals, foraminiferal débris, many diatoms, a few coccoliths. No Radiolaria were observed.

Sample B.—Four tubes of dark blue-grey clay, about 1 ounce. No macroscopic organisms. Dried dark blue-grey and was refractory, splitting up into laminated flakes in water. Was dried again and broke down in a weak solution of soda. *Sieves* contained large flakes of refractory material, some pellets of clay, a few dead shells of Foraminifera, Radiolaria, sponge-spicules. *Residues*, clay pellets, angular minerals, many diatoms and sponge-spicules, a few immature Foraminifera. No coccoliths observed.

No. 8. Near Station 242. [Label :—March 31, 1912. 45° 13′ 1″ S., 172° 45′ 3″ E., 790 fms.]

Material.—A dried sounding, 4·5 c.c. nearly white mud, without macroscopic organisms. *Sieves* retained little residue, almost pure *Globigerina*, mica, fine minerals, but yielded several notable species :—*Thurammina papillata*, *Trochammina pauciloculata*, *Cyclammina orbicularis*, *Seabrookia earlandi*. *Residues*, immature and broken *Globigerina* and other Foraminifera, mica, mineral grains. Many coccoliths and diatoms.

No. 9.—Very near Station 244. [Label :—Dec. 15, 1912, 45° 41′ 6″ S., 174° 43′ E., 639 fms.]

Material.—A sounding, 1·5 c.c. pale french-grey mud in formalin. Dried white. A fine amorphous mud containing minute Foraminifera and a few mineral flakes. Hardly any residue on sieves, mostly *Globigerina* and mica. Notable species *Bolivina beyrichi*, *Discorbina millettii*, *Truncatulina robertsoniana*. *Residues*, minute and broken Foraminifera, diatoms, minerals, many coccoliths.

No. 10.—Near Station 208. [Label :—49° 26′ 3″ S., 172° 04′ 3″ E., 138 fms.]

Note :—The constituent organisms indicate a greater depth, the label may possibly be incorrect as regards depth.

Material.—A sounding, in spirit, 12 c.c. of white ooze with abundant Globigerinae and other Foraminifera, very little mineral matter. Almost a pure foraminiferous deposit. Notable species :—*Hyperammina elongata*, var. *laevigata*, *Clavulina cylindrica*, *Bolivina robusta*, *Lagena* abundant and varied. *Residues*, a very fine calcareous mud, chiefly immature and broken down Foraminifera. Very few minerals, diatoms or coccoliths.

No. 11.—Near Station 209. [Label :—Dec. 19, 1911, 51° 30′ 4″ S., 172° 12′ E., 289 fms.]

Material.—12 c.c. dry white ooze, with a large proportion of amorphous carbonate of lime, and hardly any other mineral matter. Tenacious when wet. *Uvigerina* varied and abundant. Notable species :—*Frondicularia inaequalis*, *Sagrina dimorpha*, *Ramulina globulifera*, *Anomalina sinuosa*. *Residues* contained minute and comminuted *Globigerina*, much amorphous carbonate of lime, many coccoliths.

No. 12.—Near Station 241. [Label :—March 29, 1912, 50° 11′ S., 169° 08′ E., 301 fms.]

Material.—A sounding, in spirit, 13 cc. dirty-white ooze, *Globigerina* and other Foraminifera in a dense calcareous mud. Notable species :—*Biloculina depressa*, var. *serrata*, *Bulimina echinata*. *Residues* contained abundant immature *Globigerina*, other Foraminifera, and coccoliths, many fine mineral particles, a few sponge-spicules.

No. 13.—Very near Station 253. [Label :—Dec. 21, 1912, 54° 37′ 9″ S., 176° 24′ 2″ W., 3,003 fms.]

Material.—Three soundings, in formalin, about 27 c.c. pale brown ooze of mixed radiolarian and diatom origin. Dried buff colour. *Sieves* contained Radiolaria, some large, sand-grains both rounded and angular, a few arenaceous Foraminifera, but hardly any calcareous organisms. Notable species :—*Spiroloculina tenuis*, *Thurammina papillata*, var. *castanea* and var. *albicans*, *Haplophragmium anceps*, *H. sphaeroidiniforme*. *Residues* largely diatom and radiolarian débris, angular minerals, some sponge-spicules.

No. 14.—Near Station 215. [Label :—Dec. 26, 1911, 63° 59′ S., 174° 13′ W., 1,801 fms.]

Material.—A sounding, in formalin, 1·5 c.c. of creamy yellow diatom ooze. The sieves contained only a few *Globigerina* and other Foraminifera in a felted mass of Radiolaria and diatoms. The only notable species was *Lagena plumigera*. *Residues* :—Radiolaria and diatoms in all stages of comminution.

No. 15.—Very near Station 260. [Label :—62° 20′ 4″ S., 167° 45′ W., 1,627 fms.]

Material.—A sounding, in formalin, 3 c.c. light buff diatom ooze, drying white. *Sieves* contained a few *Globigerina* and other Foraminifera, Radiolaria, diatoms, a few Hexactinellid spicules and angular minerals. Notable species :—*Miliolina oblonga* and *Reophax distans*. *Residues* consisted of diatoms, Radiolaria and minute *Globigerina*, but practically no mineral particles.

No. 16.—Very near Station 262. [Label :—Dec. 26, 1912, 64° 33′ 4″ S., 166° 30′ W., 1,600 fms.]

Material.—Three soundings, in formalin, estimated 36 c.c. pale brown ooze, drying cream colour, consisting of *Globigerina* and abundant other Foraminifera, Radiolaria, minerals (some rounded) in a diatomaceous mud. Notable species :—*Cyclammina orbicularis*, *Seabrookia earlandi*, *Lagena exsculpta*, *L. aspera*, *L. hispida*, *L. plumigera*, *Polymorphina longicollis*, *Sagrina virgula*. *Residues*, a fine mud, largely diatomaceous, some Radiolaria, and immature Foraminifera, fine angular minerals.

No. 17.—Very near Station 265. [Label :—Dec. 27, 1912, 66° 29′ 8″ S., 166° 8′ W., 1,894 fms.]

Material.—13 c.c. pale brown ooze sounding, in formalin, dried yellowish cream. Tenacious and difficult to clean. *Sieves* contained *Globigerina* and other Foraminifera, Radiolaria (chiefly Sphaerellaria) a few angular minerals. Notable species :—*Seabrookia earlandi*, *Polymorphina lanceolata*, many *Lagena* including *L. danica*, *L. foveolata*, *L. longispina*, *L. seminuda*. *Residues*, amorphous impalpable mud, with immature Foraminifera, Radiolaria, diatoms, much calcareous débris.

No. 18.—Station 171. [Label :—Dec. 10, 1910, 66° 38′ S., 178° 47′ W., 1,964 fms.]

Material.—12 c.c. brown mud sounding, in spirit, dried light grey. *Sieves :*—*Globigerina* and other Foraminifera and débris of the same with Radiolaria, diatoms and a few angular minerals. Notable species :—*Sigmoilina ovata*, *Ammodiscus charoides*, *Ehrenbergina hystrix*, many species of *Lagena*, *Pulvinulina pauperata*. *Residues* almost entirely organic, *Globigerina* and diatom débris, Radiolaria, very fine minerals.

No. 19.—Near Stations 173–174. Sounding A. [Label :—Dec. 11, 1910, 66° 55′ S., 178° 51′ W., 2,015 fms.]

Material.—About 6 c.c. light brown ooze sounding, in spirit, dried very pale brown, broke down readily. An ooze of mixed *Globigerina*, diatom and mineral origin. *Sieves* contained thick-walled dead *Globigerina*, many other Foraminifera, a few mineral grains, some being large, many small pellets of clay which had resisted disintegration. Notable species :—*Biloculina elongata*, *Miliolina tricarinata*, *Cyclammina pusilla*, *Sphaeroidina bulloides*. *Residues* contained fragmentary and immature *Globigerina*, diatoms, fine minerals, amorphous pellets of clay.

No. 20.—Near Stations 173–174. Sounding B. [Label :—Dec. 13, 1910, 67° 30′ 1″ S., 177° 57′ 1″ W., 2,131 fms.]

Material.—15 c.c. brown ooze, in spirit, dried pale grey, and did not readily disintegrate. Dried again and broke down in weak soda into a fine homogeneous mud of mineral and diatom origin. *Sieves* contained *Globigerina* and other Foraminifera, angular minerals. Notable species :—*Ammodiscus charoides*, various *Lagena*. *Residues*, angular minerals, immature and broken Foraminifera, diatoms, Radiolaria, sponge-spicules.

No. 21.—Near Station 227. [Label :—March 14, 1912, 68° 45′ S., 172° 38′ E., 1,749 fms.]

Material.—A sounding, 12 c.c. pale brown clay in formalin, dried grey, tenacious and difficult to wash even after drying. *Sieves* contained many mineral grains of varying sizes, abundant sponge-spicules and diatoms, a few Radiolaria, and very few Foraminifera. Notable species :—*Thurammina papillata*, var. *albicans*,

Ammodiscus charoides, *Cyclammina pusilla*. *Residues*, a fine mud of minerals, diatoms, sponge-spicules with a few Radiolaria.

No. 22.—Near Station 180. [Label:—Dec. 20, 1910, 68° 40′ 5″ S., 179° 27′ 7″ W., 1,802 fms.]

Material.—A sounding 13·5 c.c. yellowish brown mud, in spirit, dried light grey and broke down readily. *Sieves* contained *Globigerina* and other Foraminifera with angular minerals of varying sizes in about equal proportions, also many Radiolaria, a few diatoms and sponge-spicules. Notable species:—*Marsipella cylindrica*, *Reophax difflugiformis*, *Haplophragmium sphaeroidiniforme*, *Bolivina decussata*, varied *Lagena*. *Residues*, *Globigerina* débris, minerals, Radiolaria and diatoms, the finest residue largely diatomaceous.

No. 23.—Station 184. [Label:—Dec. 26, 1910, 69° 08′ 8″ S., 178° 12′ 7″ W., 1,816 fms.]

Material.—A sounding, 12 c.c. pale brown mud in spirit, dried very pale brown, but did not break down in water. Dried again and broke down in weak soda into an impalpable mud of mineral origin. *Sieves* contained abundant angular mineral grains, some large with sessile organisms, *Globigerina* and other Foraminifera, clay pellets, some sponge-spicules, and a few diatoms. Notable species:—*Spiroloculina tenuis*, *Cyclammina pusilla*, varied *Lagena*, *Nodosaria raphanistrum*. *Residues*, heavy clay-pellets and angular minerals, foraminiferal débris, diatoms.

No. 24. Near Station 184. [Label:—Dec. 28, 1910, 69° 16′ 6″ S., 179° 43′ 2″ W., 2,035 fms.]

Material.—A sounding, 15 c.c. light brown clay, in spirit, dried light grey and did not break down in water. Dried again it broke down into layers. Dried once more it broke down in weak soda into a fine mud of mixed mineral and organic origin, still exhibiting a tendency to cohere into pellets. *Sieves* contained angular minerals of varying sizes, some large, sponge-spicules, clay-pellets, a few large diatoms and Radiolaria but practically no Foraminifera, the only species recorded being *Psammosphaera fusca*, *Haplophragmium latidorsatum*, *Cyclammina. pusilla*, *Globigerina dutertrei*. *Residues*, mineral particles cohering into pellets, diatoms.

No. 25. Near Station 193. [Label:—Feb. 22, 1911, 68° 41′ 6″ S., 165° 57′ E., 1,435 fms.]

Material.—A sounding, 12 c.c. of tenacious brown clay with dark specks, in spirit. Dried light grey and broke up into a fine mud of mineral and diatom origin with abundant sponge-spicules and some Radiolaria, but very few Foraminifera. Notable species:—*Cyclammina pusilla*, *Reophax difflugiformis*, *Haplophragmium tenuimargo*, *Hormosina globulifera*, *Trochammina trullissata*, *T. rotaliformis*. *Residues*, diatoms and diatomaceous débris, sponge-spicules, Radiolaria, minerals.

No. 26. Station 194. [Label:—Feb. 22, 1911, 69° 43′ S., 163° 24′ E., off Oates Land, 180–200 fms.]

Material.—A small tube of selected Foraminifera and considerable quantity of zoophytes, Polyzoa and sandy débris in formalin, also similar material with mud in spirit. Very difficult to clean, the sieves retaining a felted mass of sponge and Polyzoan débris which required to be broken up with a brush. Foraminifera plentiful, but in poor condition, many sessile forms, notably *Truncatulina refulgens*, abundant on the Polyzoa. *Wagnerella borealis* (Heliozoa) was observed. Notable species:—*Miliolina bucculenta*, *Miliolina oblonga*, var. *arenacea*, *Articulina funalis*, *Cornuspira selseyensis*, *Astrorhiza limicola*, *Dendronina limosa*, var. *humilis*, *Iridia diaphana*, *Sorosphaera confusa*, *Crithionina pisum*, *C. granum*, *Reophax distans*, *Haplophragmium crassimargo*, *H. canariense*, var. *variabilis*, *H. nanum*, *Ammodiscus shoneanus*, *Bulimina chapmani*, *Ehrenbergina hystrix*, var. *glabra*. *Residues* contained angular minerals, sponge-spicules, diatoms, immature Foraminifera, chiefly Arenacea.

No. 27. Near Station 194. Sounding A. [Label:—Feb. 22, 1911, 69° 4′ S., 163° 24′ E., 178 fms.]

Material.—12 c.c. grey-brown mud, in spirit, easily cleaned. *Sieves* contained mineral grains of all sizes, abundant Foraminifera, sponge-spicules, diatoms. Notable species:—*Miliolina oblonga*, var. *arenacea*, *Haplophragmium glomeratum*, *Bulimina subteres*, *B. chapmani*, *Cassidulina nitidula*, *Frondicularia pygmaea*, *Marginulina glabra*. *Residues* consisted of fine minerals, immature Foraminifera, diatoms, sponge-spicules and abundant amorphous particles (? volcanic ash).

No. 28. Near Station 194. Sounding B. [Label:—Feb. 22, 1911, 69° 14′ 5″ S., 164° 24′ 2″ E., 1,177 fms.]

Material.—12 c.c. tenacious chocolate clay, in spirit, dried light grey and broke down into flakes like a true clay. Dried again it broke down into a fine mud principally diatomaceous, fine minerals, sponge-spicules. Foraminifera rare, almost entirely Arenacea. Notable species:—*Reophax difflugiformis*, *R. distans*, *Haplophragmium foliaceum*, *Hormosina globulifera*, *Ammodiscus charoides*, *Cyclammina pusilla*. *Residues* contained fine minerals, abundant sponge-spicules, diatoms, and some Radiolaria.

No. 29. Near Station 194. Sounding C. [Label:—Feb. 23, 1911, 69° 29′ 5″ S., 162° 49′ 4″ E., 951 fms.]

Material.—12 c.c. grey-brown mud, in spirit. *Sieves* contained dark mineral grains, both rounded and angular, a few Foraminifera, and Radiolaria, abundant sponge-spicules and diatoms. Notable species:—*Bathysiphon filiformis*, *Hyperammina elongata*, var. *laevigata*, *Placopsilina cenomana*, *Haplophragmium globigeriniforme*, *Ammodiscus charoides*, *Cyclammina orbicularis*, *Spiroplecta annectens*. *Residues*, angular minerals, abundant sponge-spicules, diatoms.

No. 30. Near Stations 194–195. Sounding D. [Label :—Feb. 23, 1911, 69° 15′ S., 161° 58′ E., 245 fms.]

Material.—9 c.c. dark grey sandy mud, in spirit, dried light grey. *Sieves* contained angular and sub-rounded minerals of all sizes, but hardly any organisms, except a few Foraminifera, sponge-spicules and diatoms. Notable species :—*Miliolina seminulum*, *Virgulina subsquamosa*, *Cassidulina subglobosa*, var. *tuberculata*. *Residues* consisted of fine mineral grains with practically no organic constituents.

No. 31. Near Stations 194–195. Sounding E. [Label :—Feb. 26, 1911, 68° 51′ 7″ S., 158° 34′ E., 268 fms.]

Material.—4·5 c.c. light grey muddy sand in spirit. *Sieves* contained fine minerals, many sponge-spicules, a few Foraminifera. Notable species :—*Biloculina irregularis*, *Bulimina echinata*, *Seabrookia earlandi*, *Lagena exsculpta*, *Spirillina tuberculata*. *Residues* consisted of fine minerals, sponge-spicules, a few minute Foraminifera, diatoms.

No. 32. Near Stations 194–195. Sounding F. [Label :—Feb. 27, 1911, 68° 46′ S., 158° 57′ E., 1,165 fms.]

Material.—15 c.c. pale chocolate mud, in spirit, dried pale brown. *Sieves* contained clay-pellets, sponge-spicules, Foraminifera, diatoms, Radiolaria and minerals. Notable species :—*Reophax longiscatiformis*, *Haplophragmium foliaceum*, *H. agglutinans* (very long and pauperate), *H. glomeratum*, *Cyclammina pusilla*, *C. orbicularis*, *Placopsilina cenomana*. *Residues* consisted of minerals and diatoms in about equal proportions with abundant sponge-spicules.

No. 33. Near Stations 194–195. Sounding G. [Label :—March 4, 1911, 67° 6′ 5″ S., 160° 53′ 8″ E., 1,448 fms.]

Material.—12 c.c. very tenacious pale chocolate clay, in spirit. Dried pale grey and broke down readily in water but proved difficult to clean. *Sieves* contained diatoms, Radiolaria, sponge-spicules, clay-pellets, a few mineral grains and very few Foraminifera. Notable species :—*Haplophragmium glomeratum*, *H. foliaceum*, *H. scitulum*, *Trochammina nitida*, *Clavulina communis*, *Spiroplecta annectens*. *Residues* consisted of clay-pellets and minerals, with abundant diatoms and sponge-spicules.

No. 34. Near Stations 194–195. Sounding H. [Label :—March 4, 1911, 66° 43′ 8″ S., 161° 9′ E., 1,502 fms.]

Material.—10·5 c.c. homogeneous dark brown clay, in formalin, dried pale grey. Broke down readily in water into flocculent pieces which resisted further disintegration. *Sieves* contained clay-pellets, mineral grains of varying sizes (one very large), Radiolaria, sponge-spicules, diatoms and very few Foraminifera. Notable species :—*Reophax difflugiformis* and *Trochammina robertsoni*. *Residues*

consisted of clay-pellets, minerals, Radiolaria, sponge-spicules, and abundant diatoms.

No. 35. Near Stations 194–195. Sounding I. [Label :—March 5, 1911, 66° 06′ 1″ S., 161° 09′ 2″ E., 1,668 fms.]

Material.—12 c.c. pale chocolate mud with dark grains, in formalin, dried grey and washed easily. *Sieves* contained dark minerals, abundant Radiolaria and diatoms and a few Foraminifera. Notable species :—*Reophax difflugiformis*, *R. distans*, *Trochammina robertsoni*, *T. pauciloculata*. *Residues* consisted of diatoms, Radiolaria and fine minerals.

No. 36.—Station 270. [Label :—Dec. 29, 1912, 69° 51′ S., 166° 17′ W., 2,216 fms.]

Material.—A sounding, 13·5 c.c. pale brown ooze, in formalin, dried cream colour, tenacious and difficult to clean. *Sieves* contained a pebble, large angular minerals, clay-pellets, diatoms, *Globigerina* and other Foraminifera. Notable species :—*Biloculina depressa*, var. *murrhyna*, *Spiroloculina tenuis*, very varied Lagenae, *Nodosaria calomorpha*, *N. mucronata*, *N. raphanistrum*, *Discorbina chasteri*. *Residues* consisted of minute minerals, diatoms, immature *Globigerina*.

No. 37.—Near Station 218, Cape Adare (?). [Label :—Near 218 (?), 65° 30′ 6″ S., 176° 27′ 7″ W., 1,120 fms.]

Material.—A sounding, 2 c.c. pale fawn mud, in formalin. *Sieves* contained a felted mass of Radiolaria and diatoms, a few angular sand-grains and Foraminifera, but none of note. *Residues* consisted of diatoms and Radiolaria.

No. 38.—Station 220. [Label :—Jan. 3, 1912, Off Cape Adare, mouth of Robertson's Bay, 45–50 fms.]

Material.—Organic débris, principally Hydrozoan fragments mixed with black pebbles and sand, difficult to clean. *Sieves* contained a felted mass of Hydrozoan débris, diatoms (*Triceratium*), sponge-spicules and basaltic sand with abundant spherical bodies (? Zeolites), a few Foraminifera. Notable species :—*Crithionina pisum*, *C. rugosa*, var. *hispida*, *Bulimina chapmani*, *Cassidulina parkeriana*, *Ehrenbergina hystrix*, var. *glabra*, *Discorbina chasteri*. The Heliozoan *Wagnerella borealis* was also noted. *Residues* consisted of diatoms, sponge-spicules, angular minerals and a few immature Foraminifera.

No. 39.—Station 289. [Label :—Jan, 12, 1913, 72° S., 168° 17′ 5″ W., 2,322 fms.]

Material.—A sounding 4·5 c.c. light brown plastic mud, dried whitey-grey, very refractory. *Sieves* contained only 0.3 c.c. grey residue of pellets and flakes of clay, and a few mineral grains, and very few Radiolaria. The only Foraminifera recorded were *Cyclammina pusilla* (3), *Haplophragmium latidorsatum* (1),

Webbina clavata (1), all starved specimens. *Residues* consisted of extremely fine mineral particles, with a few diatoms and sponge-spicules.

No. 40.—Station 291. [Label :—Jan. 14, 1913, 72° 40′ 9″ S., 172° 37′ 5″ W., 1,917 fms.]

Material.—Soundings, 28 c.c. of light brown-grey mud, in formalin, dried nearly white and difficult to wash. *Sieves* retained only 1·25 c.c. of angular minerals, sponge-spicules, diatoms and Radiolaria with a few Foraminifera. Notable species :—*Reophax ampullacea*, *R. difflugiformis*, *Thurammina papillata*, *Trochammina paucilocula*ta, *Ammodiscus shoneanus*. *Residues*, almost entirely diatomaceous with some Radiolaria and fine minerals.

No. 41.—Near Station 188. Sounding A. [Label :—Jan. 2, 1911, 75° 9′ 7″ S., 173° 39′ 8″ E., 251 fms.]

Material.—10·5 c.c. light olive brown mud, in formalin, dried greenish white. *Sieves* contained angular minerals, sponge-spicules, Radiolaria, abundant diatoms, but very few Foraminifera. Notable species :—*Miliolina oblonga*, var. *arenacea*, *Psammosphaera rustica*, *Reophax spiculifera*, *R. longiscatiformis*, *Bolivina punctata*, var. *arenacea*. *Residues* consisted almost entirely of diatoms and Radiolaria, with some sponge-spicules and minerals.

No. 42. Near Station 188. Sounding B. [Label :—Jan. 2, 1911, 74° 24′ 7″ S., 174° 1′ 3″ E., 313 fms.]

Material.—12 c.c. of pale grey brown mud with darker grains, in formalin. Very tenacious and refractory, splitting up in water into flocculent layers as though stratified. Dried again it broke down in soda into a clay-like mud. *Sieves* contained angular minerals, some large, Radiolaria, a few sponge-spicules and diatoms, and very few Foraminifera. Notable species :— *Haplophragmium anceps*, *Ammodiscus charoides*, *Cyclammina pusilla*, *Trochammina rotaliformis*, *Clavulina communis*. *Residues* consisted of minerals, sponge-spicules, diatoms and minute irregular pellets of clay in all stages of disintegration into their constituents, a débris of fine mineral, Radiolarian and diatom-fragments.

No. 43.—Near Station 221. [Label :—Jan. 8, 1912, 75° 25′ S., 165° 11′ E., 400 fms.]

Material.—A sounding, 10·5 c.c. of slate-brown mud with dark mineral grains, in formalin, dried very light grey. *Sieves* contained angular minerals, many sponge-spicules and Radiolaria, abundant diatoms, but very few Foraminifera. Notable species :—*Miliolina oblonga*, var. *arenacea*, *Haplophragmium scitulum*, *H. anceps*. *Residues* consisted of angular minerals, sponge-spicules, and abundant diatoms.

No. 44.—Station 222. [Label :—Jan. 10, 1912, 76° 02′ 7″ S., 165° 55′ 2″ E., 303 fms.]

Material.—A sounding, 12 c.c. of yellow-grey diatom ooze, with many dark mineral grains, in formalin, dried light grey. *Sieves* contained dark rounded minerals, sponge-spicules and Foraminifera. Notable species:—*Bathysiphon argenteus*, *Haplophragmium fontinense*, *H. glomeratum*, *Trochammina trullissata*. *Residues* consisted of diatoms and sponge-spicules.

No. 45.—Station 340. Jan. 25, 1912, 76° 56′ S., 164° 12′ E., 160 fms.

Material.—Débris of Polyzoa, Echinoderms and Sponges with a small quantity of muddy sand, in spirit. Difficult to clean. *Sieves* contained a felt of débris with rounded minerals, diatoms, sponge-spicules and Foraminifera. Notable species:—*Dendronina arborescens*, var. *antarctica*, *Rhizammina algaeformis*, *Crithionina pisum*, *Reophax advena*, *Thurammina papillata*, var. *haeusleri*. *Residues* consisted of minerals, abundant diatoms and sponge-spicules, and many immature Foraminifera.

No. 46.—Station 356. Jan. 22, 1913, off Granite Harbour, entrance to McMurdo Sound, 50 fms.

Material.—Organic débris with a little sand, in spirit, difficult to clean. *Sieves* contained a felted mass of sponge-fragments and spicules, with scanty Foraminifera. Notable species:—*Haplophragmium nanum*, *H. canariense*, var. *variabilis*, *Thurammina papillata*, var. *haeusleri*, *Bulimina chapmani*, *Cassidulina parkeriana*, *Ehrenbergina hystrix*, var. *glabra*. A small Pycnogonid was observed bearing sessile specimens of *Ammodiscus gordialis* (many) *Trochammina squamata*, *Discorbina globularis* and *Truncatulina refulgens*. *Residues* consisted of diatoms, sponge-spicules and minerals.

No. 47.—Station 339. Jan. 24, 1912, 77° 5′ S., 164° 17′ E., 140 fms.

Material.—Polyzoan and Echinoderm débris with a little black sand, in formalin. Difficult to clean. *Sieves* contained a felt of débris, but very few Foraminifera except *Truncatulina refulgens*, which was abundant. Notable species:—*Reophax longiscatiformis*, *Thurammina papillata*, var. *haeusleri* and *Patellina corrugata*, showing development of young individuals in basal cavity. *Residues* consisted of dark angular minerals, a few sponge-spicules and diatoms, and very few immature Foraminifera.

No. 48.—Station 331. Jan. 14, 1912. Off Cape Bird Peninsula, entrance to McMurdo Sound, 250 fms.

Material.—Sand and organic débris in spirit, similar material in formalin, and a few selected Foraminifera. *Sieves* contained a mass of Echinoderm, Polyzoan, Hydrozoan and sponge débris, with black volcanic sand. Foraminifera poorly represented except *Cassidulina*, very common. Notable species:—*Miliolina calcarata*, *Iridia diaphana*, *Pelosina cylindrica*, *Ammodiscus shoneanus*. A specimen of *Truncatulina lobatula* containing embryo shells was recorded. *Residues* consisted of angular minerals, volcanic ash, sponge-spicules in great abundance, diatoms, and a few immature Foraminifera.

No. 49.—Near Station 335. Jan. 20, 1912, 77° 10′ 8″ S., 164° 13′ E., 187 fms.

Material.—A sounding, 9 c.c. of dark olive sandy mud, in formalin, dried grey. *Sieves* contained dark minerals, Polyzoan and Annelid débris, abundant sponge-spicules and diatoms, very few Foraminifera. Notable species :—*Reophax dentaliniformis* and *Operculina ammonoides*. *Residues* consisted of minerals, rounded and angular, abundant diatoms and sponge-spicules, a few Radiolaria.

No. 50.—Station 338. Jan. 23, 1912, 77° 13′ S., 164° 18′ E., 207 fms.

Material.—Corallines encrusted with *Truncatulina refulgens*, coralline- and sponge-débris, much organic flocculent matter, mud and fine black rounded volcanic sand, in formalin. Difficult to wash. *Sieves* contained a felt of débris. Foraminifera fairly numerous, but more or less decalcified by the formalin. Notable species :—*Miliolina oblonga*, var. *arenacea*, *M. calcarata*, *Iridia diaphana*, *Reophax dentaliniformis*, *Thurammina papillata*, var. *favosa* (compressed type). *Residues*, dark angular minerals, sponge-spicules, diatoms, a few immature Arenacea.

No. 51.—Station 333. Jan. 17, 1912, 77° 22′ 5″ S., 165° 22′ E., 418 fms.

Material.—A sounding, 12 c.c. dark olive green (almost black) mud, in formalin, dried white-grey with a green tinge. *Sieves* contained rounded and angular minerals, some Radiolaria, sponge-spicules and a few Foraminifera in poor condition, all Arenacea except *Miliolina oblonga*, var. *arenacea*, which itself is of adventitious construction. How far the formalin was responsible for the entire absence of calcareous forms is unknown. *Residues* almost entirely diatomaceous, with some sponge-spicules and minerals.

No. 52.—Station 342. Jan. 31, 1912, 77° 36′ S., 165° 30′ E., 416 fms.

Material.—Soundings, 18 c.c. dark olive mud with darker grains, in formalin, dried light grey, and proved very refractory. *Sieves* contained angular minerals, lumps of grey mud resisting disintegration, many sponge-spicules, Radiolaria and diatoms, very few Foraminifera, principally Arenacea. Notable species :—*Miliolina oblonga*, var. *arenacea*, *Reophax dentaliniformis*, *Bolivina punctata*, var. *arenacea*, *Verneuilina pusilla*. *Residues*, diatoms with angular minerals, sponge-spicules and Radiolaria.

No. 53.—Station 348. Feb. 13, 1912, off Barne Glacier, McMurdo Sound. 200 fms.

Material.—Polyzoan and other organic débris and muddy sand, in formalin. *Sieves* contained débris, sponge-spicules, diatoms, a few minerals, a few Foraminifera, mostly small. Notable species :—*Iridia diaphana*, *Thurammina papillata*, var. *haeusleri*, *Bulimina chapmani*, *Discorbina chasteri*. *Residues*, diatomaceous with some sponge-spicules, a few minerals and minute Foraminifera.

No. 54.—Station 314. Jan. 23, 1911, 5 miles North of Inaccessible Island, McMurdo Sound, 222-241 fms. [Label : Jan. 23, 1911, McMurdo Sound.]

Material.—Originally in spirit, but dried into a hard cake of mud and sand, which did not readily disintegrate. *Sieves* contained a felt of sponge-spicules, diatoms. Foraminifera varied, but not abundant, except *Cassidulina subglobosa*, *C. crassa*, *Ehrenbergina hystrix*, var. *glabra* and *Uvigerina angulosa*. *Residues* consisted of angular minerals, volcanic ash, abundant sponge-spicules and diatoms, a few minute Foraminifera.

No. 55.—Station 355. Jan. 20, 1913, 77° 46′ S., 166° 8′ E., 300 fms.

Material.—Organic débris, mud and sand, in a mixture of spirit and formalin. Very difficult to clean. *Sieves* contained Sponge, Alcyonarian and Hydroid débris, with angular minerals and some Foraminifera, *Truncatulina refulgens* predominating. Notable species:—*Psammosphaera rustica*, *Verneuilina pusilla*, *Bulimina chapmani*, *Cassidulina bradyi*, var. *elongata*, *Lingulina biloculi*, *Spirillina obconica*, and var. *carinata*, *Patellina corrugata*. *Residues* consisted of minute minerals, sponge-spicules, diatoms and a few Foraminifera, mostly immature.

No. 56.—Station 308. April 9, 1913 (To West of Tierra del Fuego), 55° 29′ S., 78° 54′ W., 2,356 fms.

Material.—A sounding, 10·5 c.c., pale brown ooze, in spirit, dried cream colour. Globigerinidae and Radiolaria in a diatomaceous mud. *Sieves* contained Foraminifera and Radiolaria, mostly dead and opaque shells, débris of the same, diatoms, a few angular minerals. Notable species:—*Aschemonella catenata*, *Spiroplecta biformis* and *Pleurostomella subnodosa*. *Residues* consisted of diatoms and Radiolaria and a few minerals.

IV. SPECIES AND VARIETIES RECORDED.

By the time this Report was ready for impression the cost of paper and printing had reached the point which is recorded for all time in the aspect of the Scientific Journals of to-day. The Director, whilst giving us practically a free hand, appealed to us to meet this situation. Apart from compression of the Introductory portion of our report, we have endeavoured to meet it mainly by the suppression of six thousand synonyms. Excepting where necessitated by our "Notes," and in cases where the discussion of life-histories renders an ample synonymy essential, we have reduced our references to two—the original description and one reference to a work in which either a sufficient synonymy will be found, or works containing it are referred to. Synonymies may be said to be virtually complete in Brady, 1884 F.C.,* down to 1880; in Millett, 1898, etc., F.M. (who generally omits Brady and everything before him, excepting the original author) down to 1903; and in Cushman 1910, etc., F.N.P., down to 1915. We have therefore made use principally of these authors, especially Dr. J. Augustine Cushman, whose synonymies are a

* For explanation of this system of condensed reference, see p. 236.

marvel of patient research and accurate record, to whom we beg in this place to record a warm tribute of admiration, and of thanks for the unrestricted use we have made of his work. We have also made free use of the full synonymies in our Kerimba monograph (1914, etc., F.K.A.).

As originally compiled we gave references to all the principal papers which have dealt with New Zealand and Antarctic Foraminifera, but these have been sacrificed under the self-denying ordinance. These works are set out in the part of our Introduction dealing with the Literature of the subject, and should be referred to by future students of the areas.

For the same reason we have suppressed "frequencies" and "Tables of Distribution"—probably the most expensive form of printing extant—and also the "Lists of Species" found in the outside gatherings from Tierra del Fuego, Kerguelen Island, Rio de Janeiro; and the "Discovery" material, described in Appendices A–D. In their place we have added after the "Lists of Stations" the letters R. d. J., K. I., T. d. F., and D., to indicate that the species was found in these samples of material.

Sub-Kingdom PROTOZOA.

Class RHIZOPODA.

Order FORAMINIFERA.

Family GROMIIDÆ.

GROMIA, Dujardin.

1.—*Gromia oviformis*, Dujardin.

Gromia oviformis, Dujardin, 1835, Ann. Sci. Nat. Zool. [2], vol. iv, p. 343, pl. ix, figs. 1, 2.

Stations 46, 53, (?) 54.

A single large individual at Stn. 46, free from incrustation, several more or less incrusted at Stn. 53, and two large but somewhat doubtful specimens at Stn. 54.

Family MILIOLIDAE.

Sub-Family NUBECULARIINAE.

NUBECULARIA, Defrance.

2.—*Nubecularia tibia*, Jones and Parker.

Nubecularia tibia, Jones and Parker, 1860, FCD. p. 455, pl. xx, figs. 48–51.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 548.

Station 6.

A few attached individuals, one with a roughened surface and closely resembling d'Orbigny's figure of *Webbina rugosa* (d'Orb., 1839, FIC, p. 126, pl. 1, figs. 16–18; and 1846, FFV, p. 74, pl. xxi, figs. 11, 12). No free specimens of the more generally recorded type were observed.

[Arenaceous isomorph, *Reophax distans*, Brady, Hyaline isomorph, *Nodosaria*

inflexa, Rss., Sessile individuals isomorphous with sessile specimens of *Reophax spiculifera*, Brady, referred to in our note on that species.]

3.—*Nubecularia tubulosa*, Heron-Allen and Earland.

Nubecularia tubulosa, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 548, pl. xl, figs. 1–5.

Stations 2, 6.

Occurs in profusion on shells, stones, and stems of Gorgonids. On many of the stones from Stn. 2 the surface is practically covered with a densely interwoven mass of these delicate little tubes. As a rule the branching tubes, intersect, the individuals preserving their identity, one tube passing over another, but in several instances what appears to be a true anastomosis of the tubules was observed.

[Arenaceous isomorph, *Sagenina frondescens*, Brady, and *S. divaricans*, Cushman.]

4. *Nubecularia lucifuga*, Defrance.

Nubecularia lucifuga, Defrance, 1825, Dict. Sci. Nat. (Strasburg, 1816–1830), vol. xxxv. p. 210; Atlas Zooph. pl. xliv. fig. 3.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 549.

Stations 2, 4, 6.

Only from the N.Z. area, where it occurs both adherent to stones and free. The specimens are not particularly robust.

[Arenaceous isomorph, *Placopsilina cenomana*, d'Orb. Hyaline isomorph, the young stage of *N. lucifuga* as figured by Sidebottom (S., 1904, etc., RFD) is *Truncatulina lobatula* (W. & J.); older specimens *T. variabilis*, Soldani type.]

5. *Nubecularia lucifuga*, var. *decorata*, Heron-Allen and Earland.

Nubecularia lucifuga var. *decorata*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 549, pl. xl, figs. 6, 7.

Station 2.

Fine and typical specimens occur on the stones from this Station.

6. *Nubecularia bradyi*, Millett.

Nubecularia inflata, Brady, 1884, FC. p. 135, pl. i, figs. 5–8.
,, *bradyi*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 550, pl. xl, figs. 8–10.

Station 6.

Two specimens, neither very typical, and which might perhaps be described as nubecularine miliolids. *N. bradyi* is a common form in tropical and subtropical Pacific gatherings, and it is interesting to record the form from N.Z. waters, from which it has also been recorded as not uncommon by Cushman (C., 1919, RFNZ, p. 636, pl. lxxv, fig. 6).

Sub-Family MILIOLININAE.

BILOCULINA, d'Orbigny.

7. *Biloculina irregularis*, d'Orbigny.

Biloculina irregularis, d'Orbigny, 1839, FAM. p. 67, pl. viii, figs. 20, 21.
,, ,, Heron-Allen and Earland, 1916, FWS. p. 206.

Stations 2–4, 6. 31, 38, 45, 46, 48, 53, 54.

Attains its maximum frequency and development in the N.Z. area at Station 6, where a good range of specimens in all stages was obtained. In the Antarctic material the specimens are, as a rule, few in number, but large and well developed at several Stations, especially Stations 46 and 53.

8. *Biloculina sphaera*, d'Orbigny.

Biloculina sphæra, d'Orbigny, 1839, FAM. p. 66, pl. viii, figs. 13–16.
,, ,, Brady, 1884, FC. p. 141 (fig.), pl. ii, fig. 4*a*, *b*.

Stations 6, 26, 54.

Sparingly represented in the N.Z. area by a fairly good series of specimens, none attaining any considerable size. The Antarctic records show a few enormous specimens characterised by extremely labyrinthic apertures.

There is an increasing tendency to refer this species to the genus *Planispirina*, on account of the arrangement of the earlier chambers, but it is so essentially biloculine in external form that we prefer to retain the original nomenclature.

9. *Biloculina bulloides*, d'Orbigny.

Biloculina bulloides, d'Orbigny, 1826, TMC. p. 297, no. 1, pl. xvi, figs. 1–4, Modèle no. 90.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 551.

Stations 1–3, 5, 6, 9, 16, 19, 36, 53–55 (+ R. d. J.).

The specimens from the N.Z. area are rather small, the best and most typical from Station 6. It is nowhere common. An abnormal individual with an accessory chamber and tubular orifice over the aperture was found at Station 2. In the deep water between N.Z. and the Antarctic circle the specimens attain better growth, but they reach their maximum dimensions in S. Polar waters, notably at Station 48, where very large individuals were found. At Station 36 both typical specimens and specimens with projecting tubular apertures (*B. lucernula*, Schwager, S, 1866, FKN, p. 202, pl. iv, fig. 17) were observed.

10. *Biloculina ringens* (Lamarck).

Miliolites ringens, Lamarck, 1804, etc., AM. vol. v, p. 351, no. 1, vol. ix, pl. xvii, fig.
Lamarck, 1816, etc., ASV. vol. vii, p. 612; 1835, etc., vol. xi, p. 289, no. 1.
Biloculina ,, Heron-Allen and Earland, 1915, FKA. p. 550.

Stations 1, 6, 48.

A good many specimens at Station 6 (N.Z.) large and typical, otherwise represented by single specimens of the depressed form figured by Brady (Fig. 7) and named

after him, *B. bradyi*, by Schlumberger (S, 1891, BGF, p. 170, text figs. 15–19, pl. x, figs. 63–71). None of the specimens show the transverse ridges of shell-matter figured by Schlumberger, but not appearing in Brady's original figure, or Chapman's (C, 1914, FORS, p. 57, pl. 1, fig. 1; and C, 1909, SNZ, p. 314, pl. xiii, fig. 1).

11. *Biloculina comata*, Brady.

Biloculina comata, Brady, 1879, etc., RRC. 1881, p. 45; 1884 FC. p. 144, pl. iii, figs. 9*a*, *b*.

Stations 1, 4, 8, 10–12.

N.Z. area only. The species attains a comparatively large size, especially at Stations 10 and 11. The individuals differ from Brady's type, which may be regarded as a striate form of *B. ringens* and *B. bulloides*. The N.Z. specimens are closely allied to *B. lucernula*, Schwager, the produced tubular neck attaining noticeable dimensions at Stations 10, 11, 12. The only individual of Brady's type observed was at Station 1.

Judging by the recorded figures of Flint, Cushman and Schlumberger, *B. comata* is normally a striate variant of *B. ringens* and *B. bulloides;* the occurrence of similar surface ornament in another type, and prevalent in a particular area, is an interesting feature.

12. *Biloculina elongata*, d'Orbigny.

Biloculina elongata, d'Orbigny, 1826, TMC. p. 298, no. 4.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 552.

Stations 19, 26, 38, 46, 47 (+ K. I., R. d. J.).

Rare and confined to the Antarctic area. Large and quite typical specimens at Stations 46, 47 and 48.

13. *Biloculina depressa*, d'Orbigny.

Biloculina depressa, d'Orbigny, 1826, TMC. p. 298, no. 7, Modèle no. 91.
,, ,, Cushman, 1910, etc., FNP. 1917, p. 74, pl. xxviii, figs. 1, 2.

Stations 1–6, 8, 10, 12, 17–20, 23, 27, 38 (+ K. I., D.).

The species reaches its maximum development, both as to numbers and size, at Station 6. At Stations 8 and 10 the individuals are furnished with a broad keel. In the Antarctic area it is much less frequent, and the specimens do not attain the development of the N.Z. forms.

14. *Biloculina depressa*, var. *murrhyna*, Schwager.

Biloculina murrhyna, Schwager, 1866, FKN. p. 203, pl. iv, figs. 15*a*, *b*.
,, ,, Cushman, 1910, etc., FNP. 1917, p. 75, pl. xxviii, fig. 3; pl. xxix, fig. 1.

Stations 10–12, 17, 18, 19, 36 (+ T. d. F.).

Occurs in company with the type at several Stations, but at others the type is not represented. Maximum development at Station 11 (N.Z.), the Antarctic specimens are much weaker, and few in number.

15. *Biloculina depressa*, var. *serrata*, Bailey.

Biloculina serrata, Bailey, 1861, New Spp. Micr. Org. Para River, S. America, Boston Journ. Nat. Hist. vol. vii, p. 350, pl. viii, fig. E.
,, ,, Cushman, 1910, etc., FNP. 1917, p. 75, pl. xxix, fig. 2.

Station 12.

A single typical specimen. The depth at this Station (301 fms.) is much below the average depth of the records for this variety, which is nearly always confined to very deep water. Brady's authorship must lapse in favour of Bailey's, whose paper being concerned principally with Diatomaceae had been overlooked in this country. The paper is recorded under dates 1862 and 1863, but our copy bears the printed date July, 1861. Bailey's specimens were from the Gulf Stream (!) 150 fms.

SPIROLOCULINA, d'Orbigny.

16. *Spiroloculina nitida*, d'Orbigny.

Spiroloculina nitida, d'Orbigny, 1826, TMC. p. 298, no. 4.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 552.

Station 5.

A single moderately good example.

17. *Spiroloculina planulata* (Lamarck).

Miliolites planulata, Lamarck, 1804, AM. p. 352, no. 4; Lamarck, 1816, etc., ASV. vol. vii, p. 613, no. 4.
Spiroloculina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 555.

Station 6 (+ R. d. J.).

A single specimen.

18. *Spiroloculina excavata*, d'Orbigny.

Spiroloculina excavata, d'Orbigny, 1846, FFV. p. 271, pl. xvi, figs. 19–21.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 554.

Stations 5, 6.

Extremely rare.

19. *Spiroloculina affixa*, Terquem.

Spiroloculina affixa, Terquem, 1878, FIR. p. 55, pl. v, fig. 13.
,, *inaequilateralis*, Schlumberger, 1893, MGM, p. 202, pl. iv, figs. 84–86.

Stations, 2, 6.

This very distinctive type, although so rare in the European waters, and fossil deposits from which it was first described, is generally one of the most typical of the N.Z. fauna. In this material, however, it occurs at only two Stations, the specimens being, however, very well developed.

20. *Spiroloculina tenuis* (Czjzek).

Quinqueloculina tenuis, Czjzek, 1848, FWB. p. 149, pl. xiii, figs. 31–34.
Spiroloculina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 556.

Stations 6, 8, 10, 13, 16, 17, 23, 36 (+ T. d. F., R. d. J.).

As usual, it is practically impossible to separate this form from *Miliolina pygmaea*, but we are recording the spiroloculine forms separately for taxonomical reasons. In both the N.Z. and Antarctic areas it occurs in two distinct forms, porcellanous and sub-arenaceous. The two occur together at Station 6, where it is best represented, and at Stations 16 and 17. The porcellanous form occurs alone at Station 8 (N.Z.), and 13 (Ant.), where the individuals are exceptionally long. At the other Stations only the sub-arenaceous type occurs, the finest specimens being found at Stations 16 and 36.

21. *Spiroloculina arenaria*, Brady.

Spiroloculina arenaria, Brady, 1884, FC. p. 153, pl. viii, fig. 12.
,, ,, de Amicis, 1893, CFP. p. 313, pl. iii, fig. 1.

Station 6.

A few very good examples.

MILIOLINA, Williamson.

22. *Miliolina circularis* (Bornemann).

Triloculina circularis, Bornemann, 1855, FSH. p. 349, pl. xix, fig. 4.
Miliolina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 557.

Stations 1–6, 26, 31, 37, 40, 46, 50, 55 (+ K. I., R. d. J., D.).

In the N.Z. area the specimens are, as a rule, very small, the best at Stations 1, 5 and 6. In the Antarctic the best series and the most abundant occur at the most southerly Station, 55, where it is well developed. At the other Stations it is extraordinarily variable in development and frequency, ranging from single small individuals to large (at Station 31) and one exceptionally large (fragmentary) at Station 37.

23. *Miliolina circularis*, var. *sublineata*, Brady.

Miliolina circularis, var. *sublineata*, Brady, 1884, FC. p. 169, pl. iv., fig. 7.
,, ,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 558, pl. xli, figs. 9–11.

Station 27.

The specimens are few in number, and but feebly striate.

24. *Miliolina valvularis* (Reuss).

Triloculina valvularis, Reuss, 1851, FSUB. p. 85, pl. vii, fig. 56.
Miliolina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 559.

Station 6.

Good specimens.

25. *Miliolina chrysostoma*, Chapman.

Miliolina chrysostoma, Chapman, 1909, SNZ. p. 322, pl. xiii, figs. 8–10; pl. xiv, figs. 1 and 4.

Stations 1, 5, 6.

A few specimens occur in the N.Z. area, which we think should be attributed to Chapman's form, resembling his figures 8 and 9. There are no instances exhibiting the extreme variation to which he refers.

26. *Miliolina labiosa* (d'Orbigny).

Triloculina labiosa, d'Orbigny, 1839, FC. p. 178, pl. x., figs. 12–14.
Miliolina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 559.

Stations 5, 6, 26, 53, 54.

Very rare, excepting at Station 26, where a good many typical examples occur.

27. *Miliolina bucculenta*, Brady.

Miliolina bucculenta, Brady, 1884, FC. p. 170, pl. cxiv, fig. 3 *a*, *b*.
,, ,, Heron-Allen and Earland, 1916, FWS. p. 208, pl. xxxix, figs. 4–6.

Stations 1, 5, 26, 38, 45, 48, 50.

Several small specimens in the N.Z. area; sparingly represented in the Antarctic; but good specimens occur at several Stations, notably at Stations 26 and 48. None of them, however, approach in size the enormous individuals found in the cold area of the Färoe Channel.

28. *Miliolina subrotunda* (Montagu).

Vermiculum subrotundum, Montagu, 1803, TB. pt. 2, p. 521.
Miliolina subrotunda, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 559.

Stations 3, 5, 6, 21.

Sparingly represented and not very typical, excepting at Station 5. The only Antarctic specimen was very small and feeble.

29. *Miliolina trigonula* (Lamarck).

Miliolites trigonula, Lamarck, 1804, etc., AM. 1804, vol. v, p. 351, no. 3.
Miliolina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 561.

Stations 2, 3, 5, 6, 9, 26, 31.

Reaches its best development in the N.Z. area at Station 6, where both the long and the short types attain fine development. The short type alone occurs at Stations 3 and 5, and the species is represented in the Antarctic by the short type only.

30. *Miliolina insignis*, Brady.

Miliolina insignis, Brady, 1879, etc., RRC. 1881, p. 45, 1884, FC. p. 165, pl. iv, figs. 8–10.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 562.

Station 6.

Specimens large and well-developed, but feebly sulcate.

31. *Miliolina tricarinata* (d'Orbigny).

Triloculina tricarinata, d'Orbigny, 1826, TMC. p. 299, no. 7, Modèle no. 94.
Miliolina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 562.

Stations 3, 5, 6, 16, 18, 19, 27, 31, 35, 38, 48, 50, 53, 54, 55.

Occurs in both the long "hazel-nut" type and the short robust form, the best at N.Z., Station 6, where the short form attains fine dimensions. The long form occurs only at Station 5 in the N.Z. area, but occurs to the exclusion of the short form in the deep-water Stations, between N.Z. and the Antarctic Continent. The short form reappears at Station 31 and occurs exclusively from there to the most southern latitudes, attaining better development as one approaches the shallower Stations of the Antarctic coast, the best individuals being obtained at Stations 38, 48, 54, and 55.

32. *Miliolina bosciana* (d'Orbigny).

Quinqueloculina bosciana, d'Orbigny, 1839, FC. 191, pl. xi, figs. 22–24.
Miliolina bosciana, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 566.

Stations 2, 3, 5, 6, 48 (+ KI).

Represented in the N.Z. area by single specimens only, except at Station 6, and all small. In the Antarctic by a single small specimen at Station 48.

33. *Miliolina oblonga* (Montagu).

Vermiculum oblongum, Montagu, 1803, TB. p. 522, pl. xiv, fig. 9.
Miliolina oblonga, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 566.

Stations 1–3, 5, 6, 15, 31, 36, 38 (+ R. d. J.).

Occurs in both the originally described and figured square-cornered form, and in the rounded type, figured by Brady. In the N.Z. area the square form predominates, the best being at Stations 1 and 5. At Station 3 the round form only occurs; at Station 6, both types together. Rare in the Antarctic, the round form at Stations 15 and 31; both types at Station 36. It is noticeable that the round type is always more thin-shelled and feebler than the angular, but none of the fragile type noted by us from West Scotland (H-A & E, 1916, FWS, p. 210) was seen in the material.

34. *Miliolina oblonga*, var. *arenacea*, Chapman.

Miliolina oblonga, var. *arenacea*, Chapman, 1914, FORS. p. 59, pl. i, fig. 7.
,, *alveoliniformis*, Fauré-Fremiet, 1913, etc., FMAF. 1914, p. 4, pl. O, fig. 5.

Stations 26, 27, 29, 32, 33, 41–45, 48, 50, 51, 52 (+ K. I., D.).

This is the most typical Miliolid of the Antarctic area, and presents a considerable range of form. The rounded type predominates, and represents the variety at most of the Stations, but the angular form occurs in its company at Stations 27, 43, 44, and 52. The test is very fragile and delicate; and the calcareous constituent, if present at all, must be very limited in quantity. The colour varies considerably. In the deeper water the specimens are a very pale

grey, almost white, but as the Polar Continent is approached the colour darkens owing to the increasing quantity of dark mineral constituent. The pale colour was at first thought to be due to the presence of diatomaceous material, but the examination of crushed specimens in balsam under a high power reveals an entire absence of such material, the test being constructed entirely of most minute mineral particles.

Fauré-Fremiet (*ut supra*) figures a form under the name of *M. alveoliniformis*, Brady, which certainly has no resemblance to Brady's type, but may be related to Chapman's, from which it differs in its cribrate aperture on a produced neck, its comparatively coarsely agglutinate test, and the arrangement of the chambers, which are on the *M. bosciana* or transverse plan, instead of the straight *M. oblonga* arrangement. The text-figure and description in his 1913 Paper (*ut supra* p. 262, fig. 4), however, shows a much less coarsely agglutinate shell, and the description brings the species into close agreement with our specimens, except that we have not observed any specimens with cribrate apertures.

35. *Miliolina gracilis* (d'Orbigny).

Triloculina gracilis, d'Orbigny, 1839, FC. p. 181, pl. xi, figs. 10–12.
Miliolina gracilis, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 567.

Station 6.

A single specimen, resembling d'Orbigny's original figure.

36. *Miliolina pygmaea* (Reuss).

Quinqueloculina pygmaea, Reuss, 1849–50, FOT. p. 384, pl. v (l.), fig. 3.
Miliolina pygmaea, Heron-Allen & Earland, 1914, etc., FKA. 1915, p. 567.

Stations 5, 8, 10, 11, 16, 17, 22, 36 (+ R. d. J.).

Frequent at a few Stations, rare at the others. The round milioline type predominates, but at Stations 10, 11 and 17 a compressed form occurs in its company in about equal proportions. The specimens at Station 17, of both types, are abnormally long and narrow.

37. *Miliolina seminulum* (Linné).

Serpula seminulum, Linné, 1767, SN. (ed. xii.) p. 1624, no. 791 ; Linné, 1788, SN. (ed. xiii.), p. 3739, no. 2.
Miliolina seminulum, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 569, pl. xlii, fig. 31.

Stations 2, 3, 5, 6, 17, 26, 30–32, 48 (+ K. I., R. d. J.).

Never very abundant. In the N.Z. area the bulk of the specimens are of the *M. vulgaris* (d'Orb.) type, but, in the Antarctic, d'Orbigny's type occurs only at Station 31, in company with typical *M. seminulum*. The best N.Z. area is Station 5, the best Antarctic Station 48, the only Station where it occurs with any frequency.

38. *Miliolina candeiana* (d'Orbigny).

Quinqueloculina candeiana, d'Orbigny, 1839, FC. p. 199, pl. xii, figs. 24–26.
Miliolina candeiana, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 570.

Stations 1, 4, 5.

Three minute individuals referable to this obscure form from Station 4. Better represented at Station 5. A single good specimen at Station 1.

39. *Miliolina venusta* (Karrer).

Quinqueloculina venusta, Karrer, 1869. MFKB. p. 147, pl. ii, fig. 6.
Miliolina venusta, Cushman, 1910, etc. FNP. 1917. p. 45, pl. xi, fig. 1.

Stations 2, 17, 18, 19, 27, 36 (+ T. d. F., R. d. J., D.).

Represented in the N.Z. area by doubtful specimens at Station 2. As might be expected, this deep-water form occurs in greatest numbers and development at the Stations to the S. of N.Z. Excellent examples at Stations 18, 19 and 36. At Station 27 (178 fms.) it is represented by a single poorly developed individual.

40. *Miliolina auberiana* (d'Orbigny).

Quinqueloculina auberiana, d'Orbigny, 1839, FC. p. 193, pl. xii, figs. 1–3.
Miliolina auberiana, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 571.

Stations 1–6, 38, 47 (+ R. d. J.).

Poorly represented. The best specimens from Station 1. At Station 6 it occurs in a variety with a double keel on the marginal edge of the chambers approaching the form figured by Silvestri (S, 1896, etc., FPS, 1896, p. 44, pl. i, fig. 21, pl. ii, fig. 1) under the name of *M. angulata*, a specific name already preoccupied by Terquem. The Antarctic specimens are very few in number, and of minute size.

41. *Miliolina calcarata*, sp. nov. Pl. I, figs. 4–6.

Stations 48, 50.

Miliolinae with spinous decoration are extremely rare. The earlier recorded example is d'Orbigny's *Triloculina echinata* (d'Orb., 1826, TMC, p. 300, No. 14), the whole surface of which is covered with minute spines. Costa's *Quinqueloculina denticulata* (C. 1853, etc., PRN, 1856, p. 325, pl. xxv, fig. 9 (error for 6)) has a spinous ornamentation round the outer edge, due to extension of the keel. Brady, Parker and Jones figured a form akin to *M. tricarinata*, with a few large blunt spines on the outer keel, under the name *M. excisa* (B. P. & J., 1888, AB, p. 215, pl. xl., fig. 33). Millett, in 1898, recorded *M. cristata* from the Malay Archipelago, a minute form between *M. cuvieriana* and *M. venusta* (M. 1898, etc., FM, 1898, p. 506, pl. xii, figs. 3, *a–c*). This has only a few blunt spines confined to the keel of the last chamber. In 1904 Sidebottom figured *M. seminulum*, var. *cornuta*, from Delos, with similar ornamentation (S, 1904, etc., RFD, 1904, p. 11, fig. 3, and pl. iii, figs. 11, 12). We ourselves have figured

and described *M. tricarinata*, var. *serrata*, from Kerimba (H.-A. & E., 1914, etc., FKA, 1915, p. 563, pl. xli, figs. 23–25), distinguished by serrated margins to the chambers.

The two specimens which we record from the Antarctic material differ considerably from any of the foregoing types, the main distinction being the continuance of the spines on the penultimate and antepenultimate chambers, thus giving a distinctive appearance to the median line of the test, as compared with Millett's figure, which, in other respects, they closely resemble. Their zoological position is probably nearest to *M. auberiana*, which does not occur at these Stations.

Test, small, quinqueloculine, chambers angular in section, furnished down the outer edge with a series of short, blunt spines, directed towards the aboral end of the chambers. Earlier chambers appearing transversely across the middle of the shell. Aperture small, directed laterally, and furnished with a prominent tooth.

Size :—Length, ·40 mm. ; Breadth, excluding projections, ·27 mm. ; Maximum breadth, ·30 mm.

42. *Miliolina cuvieriana* (d'Orbigny).

Quinqueloculina cuvieriana, d'Orbigny, 1839, FC. p. 190, pl. xi, figs. 19–21.
Miliolina cuvieriana, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 571, pl. xlii, figs. 33–36.

Station 10.

A single, rather feeble specimen.

43. *Miliolina agglutinans* (d'Orbigny).

Quinqueloculina agglutinans, d'Orbigny, 1839, FC. p. 195, pl. xii, figs. 11–13.
Miliolina agglutinans, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 575.

Stations 3, 6 (+ R. d. J.).

Confined entirely to the N.Z. area. At Station 6 the specimens are large and coarsely agglutinate. The only other record, at Station 3, consists of a single finely agglutinate small individual.

44. *Miliolina fusca* (Brady).

Quinqueloculina fusca, Brady, 1870, FTR. p. 286, pl. xi, fig. 2.
Miliolina fusca, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 576.

Station 6.

A good series of specimens.

45. *Miliolina contorta* (d'Orbigny).

Quinqueloculina contorta, d'Orbigny, 1846, FFV. p. 298, pl. xx, figs. 4–6.
Miliolina contorta, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 576.

Stations 6, 48, 50.

The best specimens occur at the only N.Z. Station, No. 6, where there is a

good series, including both the rounded and angular edged types. Otherwise very rare, the best Antarctic specimen (angular) being at Station 50.

46. *Miliolina sclerotica* (Karrer).

Quinqueloculina sclerotica, Karrer, 1868, MFKB. p. 152, pl. iii, fig. 5.
Miliolina sclerotica, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 577, pl. xliv, figs. 1–4.

Stations 2, 6.

Very rare. The most typical specimens at Station 2. At Station 6 practically inseparable from *M. contorta*.

47. *Miliolina ferussacii* (d'Orbigny).

Quinqueloculina ferussacii, d'Orbigny, 1826, TMC. p. 301, no. 18, Modèle no. 32.
Miliolina ferussacii, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 578.

Stations 1–6, 20 (+ R. d. J.).

Occurs at all the inshore N.Z. Stations, and presents a wide range of variation. The best specimens at Stations 1 and 6. At the latter a small, neatly constructed type predominates. Represented in the Antarctic by a single individual at Station 20.

48. *Miliolina polygona* (d'Orbigny).

Quinqueloculina polygona, d'Orbigny, 1839, FC. p. 198, pl. xii, figs. 21–23.
Miliolina polygona, Goës, 1894, ASF. p. 111, pl. xx, fig. 854 *a-g*; pl. xxi, figs. 859 *a–c*.
,, ,, Chapman, 1909, SNZ. p. 321, pl. xiii, fig. 6.

Station 6.

A single typical specimen.

49. *Miliolina linnaeana* (d'Orbigny).

Triloculina linneiana, d'Orbigny, 1839, FC. p. 172, pl. ix, figs. 11–13.
Miliolina linnœana, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 579.

Stations. 2, 6.

The specimens are feeble. At Station 6 they are compressed and almost spiroloculine.

50. *Miliolina brongniartii* (d'Orbigny).

Triloculina brongniartii, d'Orbigny, 1826, TMC. p. 300, no. 23.
Miliolina brongniartii, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 580.

Station 1.

A single specimen.

Sub-genus, SIGMOILINA, Schlumberger.

51. *Sigmoilina ovata*, Sidebottom.

Sigmoilina ovata, Sidebottom, 1904, etc., RFD. 1904, p. 6, pl. ii, figs. 12, 13, text-fig. 1.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 584, pl. xlv, figs. 16–18.

Stations 1–6, 18–20, 36.

Occurs in both areas, the best specimens off N.Z. At Station 6 specimens infiltrated with glauconite occur. The Antarctic specimens are, as rule, smaller and less typical.

52. *Sigmoilina edwardsi*, Schlumberger.

Planispirina (*Sigmoilina*) *edwardsi*, Schlumberger, 1887, P. p. 483 (113 in the reprint), text-fig. 8, pl. vii, figs. 15–18.
„ „ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 584, pl. xlv. figs. 19–21.

Station 6.

A single typical specimen.

53. *Sigmoilina umbonata*, sp. nov. Plate I, Figs. 7, 8.

Stations 27, 31, 45, 47, 48, 53, 55.

Test, free, minute, circular in outline with a raised central boss on each face. Edge rounded. Aperture a minute slit. Surface smooth and polished, especially on the bosses.

Dimensions :—Breadth ·20–·30 mm. ; thickness, ·20 mm.

This obscure little form, which occurs in some numbers at several Antarctic Stations, presents features analogous to *S. sigmoidea*, but differs in its circular outline and the raised central bosses. The possibility of its representing the initial stage of a large Miliolid must not be overlooked, but no specimens representing a transition between this and any Miliolid occurring at the same Station have been observed.

54. *Sigmoilina sigmoidea* (Brady).

Planispirina sigmoidea, Brady, 1884, FC. p. 197, pl. ii, figs. 1–3, and p. 194, fig. 5 *c*.
„ „ Heron-Allen and Earland, 1916, FWS. p. 216, pl. xxxix, figs. 32–34.

Stations 2, 3, 6, 16, 38 (+T. d. F.).

One long, narrow specimen at Station 3, and a few, more typical, at Station 16. At Stations 2, 3, 6, and 38, a few specimens which, though referable to this species, are characterized by their minute size, and the breadth of shell, which is almost equal to the length, giving a nearly circular outline.

55. *Sigmoilina celata* (Costa).

Spiroloculina celata, Costa, 1855, FFMV. p. 126, pl. i, fig. 14 ; 1853, etc., PRN. 1856, pl. xxvi, fig. 5.
Planispirina celata, Heron-Allen and Earland, 1916, FWS. p. 216.

Stations 5–8, 10–12 (+R. d. J.).

Confined to the N.Z. area and best represented at Station 6. Both the broad original type of Costa, figured by Schlumberger (S., 1887, P., p. 111, pl. vii, figs. 12–14), and the long, narrow type figured by Brady and named *Sigmoilina schlumbergeri* by Silvestri (S., 1904, TB. p. 267) occur. At Station 10 the original type occurs in very broad, outspreading form.

Sub-Family HAUERININAE.

ARTICULINA, d'Orbigny.

56. *Articulina funalis*, Brady.

Articulina funalis, Brady, 1884, FC. p. 185, pl. xiii, figs. 6–11.
„ „ Heron-Allen and Earland, 1914, etc., 1915, FKA. p. 587.

Stations 2, 26, 27, 31, 38, 45, 48, 53–55 (+K. I.).

Confined to the Antarctic area, excepting for two typical specimens from the N.Z. area. At a few of the Antarctic Stations near the coastline it is remarkably abundant and attains a great length. It is also extraordinarily variable in the breadth of the oral extremity. At Station 38 individuals not only attain a great size compared with the normal, but also exhibit a breadth and strength of growth exceeding all other records. They may be compared to Brady's Fig. 2, pl. xiii, attributed by him to *A. conico-articulata*. These individuals are marked at fairly regular intervals with deep constrictions, suggesting septal divisions, and an examination of the interior of the shell shows that there is an inner thickening, constricting the diameter of the tube, at these points, though the apertures remain practically constant. The bulbous initial extremity exhibits no sign of the milioline commencement predicated by Brady in his description of the species; it is merely an inflated cavity, but it is always set unsymmetrically, the maximum turgidity extending sometimes on the side of curvature, and sometimes on the opposite side.

The relationship between this form and *Articulina* is not very apparent, except through the intermediary of such specimens of *A. conico-articulata* as we figured from Kerimba (H.-A. & E., 1914, etc., FKA. 1915, p. 586, pl. xlv, figs. 32, 33) and there is something to be said for Rhumbler's action in transferring the species to a new genus, *Tubinella*, allied to *Nubecularia*. We have modified our views expressed upon this matter, as a result of the examination of this vast collection of specimens of *A. funalis*.

57. *Articulina funalis*, var. *inornata*, Brady.

Articulina funalis var. *inornata*, Brady, 1884, FC. p. 186, pl. xiii, figs 3–5.
„ „ „ „ Millett, 1898, etc., FM. 1898, p. 513, pl. xxi, fig. 11.
Tubinella inornata Rhumbler, 1906, FLC. p. 27, pl. ii, fig. 4.

Station 3.

A few typical specimens.

OPHTHALMIDIUM, Kübler.

58. *Ophthalmidium margaritiferum*, sp. nov. Pl. I, Figs. 9–12.

Stations 3, 6.

Test, porcellanous, roughly discoidal, commencing with an inflated primordial chamber, followed by one or two convolutions rather rapidly increasing in width, unseptate. The shell then becomes septate, the constrictions being, however, of

an elementary character. Successive chambers, two or three in number, occupying more than half, and up to two-thirds of a convolution. Broadest at mid-chamber length and narrowing towards the aperture, which is furnished with a thickened lip, and a rudimentary tooth. In the megalospheric form the primordial chamber projects as a clear button in the middle of the flattened disc. The microspheric form has not been found.

The nearest ally of the species would be *O. tumidulum*, Brady, with which our form agrees in the rounded shape of the peripheral margin, but differs in the greater length of the latter chambers, which, by occupying more than half of the circumference, destroy the spiroloculine plan of Brady's species. It may be regarded as a connecting link between *Planispirina exigua*, Brady, and *O. tumidulum*, Brady. The presence of the oral tooth indicates its spiroloculine affinity. Size :—·30 – ·40 mm. in diameter ; ·05 mm. in thickness.

Rare and small at Station 3, more numerous and well-developed at Station 6.

(Note.—Rhumbler (R., 1909, etc., FPE. 1909, pl. ix, fig. 18) figures a small *Ophthalmidium*, without any specific name being given in the text, which closely resembles our form.)

PLANISPIRINA, Seguenza.

59. *Planispirina cliarensis*, Heron-Allen & Earland.

Planispirina cliarensis, Heron-Allen and Earland, 1913, CI. p. 35, pl. ii, figs. 7, 8.

Station 6.

Two specimens presenting the characteristic small aperture of the type, but in one case more convex than the type, and so approaching *P. auriculata*, Egger.

Sub-Family FISCHERININAE.

FISCHERINA, Terquem.

60. *Fischerina helix*, Heron-Allen and Earland.

Fischerina helix, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 591, pl. xlvi, figs. 10–14.

Stations 4, 6.

A few specimens, smaller than the original type, but exhibiting all the characteristic features.

Sub-Family PENEROPLIDINAE.

CORNUSPIRA, Schultze.

61. *Cornuspira foliacea* (Philippi).

Orbis foliaceus, Philippi, 1844, EMS. p. 147, pl. xxiv, fig. 25 (error for 26).
Cornuspira foliacea, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 592.

Stations 6, 26, 53 (+K. I.).

Occurs in two forms, the original figure of Philippi, in which the final whorl is not very much broader than its predecessors, and in the thin compressed form

illustrated by Brady (pl. xi, fig. 5) in which there is an immense increase in the width of the final convolution. Represented in the N.Z. area by the wide-tubed type attaining comparatively enormous dimensions; one broken shell probably exceeded a quarter of an inch in diameter. Only the narrow-tubed type occurs in the Antarctic material, but at Station 26 this also reaches a very large size.

[Arenaceous isomorph, *Ammodiscus tenuis*, Brady, Hyaline isomorph, *Spirillina vivipara*, Ehbg., evolute forms.]

62. *Cornuspira selseyensis*, Heron-Allen and Earland.

Cornuspira (?) Earland, 1905, FBS. p. 199, pl. xiii, figs. 2–4.
„ *selseyensis*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 592.

Stations 4, 6, 26, 31, 38, 45, 46, 48, 53–55.

Occurs in both areas, but much more frequently in the Antarctic. It is entirely missing at all the deep-water Stations. The specimens even from the most southerly latitudes differ in no respect from the original English types. Station 31 (268 fms.) is perhaps distinctive in the exhibition of tests more stoutly constructed than is usually the case.

63. *Cornuspira involvens* (Reuss).

Operculina involvens, Reuss, 1849–50, FOT. p. 370, pl. i (xlvi), fig. 20 (not 30).
Cornuspira „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 593.

Stations 3, 5, 6, 10, 26, 31, 38, 46, 48, 50, 53–55 (+K. I., D.).

Occurs in both megalospheric and microspheric forms, both together at Stations 38 and 48, the microspheric alone at Stations 3, 5, 6 and 31, the megalospheric alone at Stations 10, 26, 46, 50, 53, 54 and 55, at all of which Stations specimens attain fine dimensions, the largest at Station 26. For its remarkable occurrence at Station 10, see our note on *Hyperammina ramosa* (No. 91).

[Arenaceous isomorph, *Ammodiscus incertus* (d'Orb.), Hyaline isomorph, *Spirillina vivipara*, Ehbg., closely coiled forms.]

64. *Cornuspira diffusa*, Heron-Allen & Earland.

Cornuspira diffusa, Heron-Allen and Earland, 1912, etc., NSG. 1913, No. 3, pp. 272–276, pl. xii.; 1913, CI. p. 37; 1916, FWS. p. 217.

Station 6.

This interesting form is quite one of the most typical Foraminifera at this Station, where it occurs in abundance and is characterized by the wildest out-growths. No individuals were found exhibiting any trace of the spiral centre observed in our type specimens; some of them, indeed, show a closed extremity to the initial portion, whilst in others the initial extremity is narrowed down to a cup-like opening suggestive of a sessile habit. It would thus appear to link *Cornuspira* with *Nubecularia*.

65. *Cornuspira striolata*, Brady.

Cornuspira striolata, Brady, 1882, FKE. p. 713; 1884, FC. p. 202, pl. cxiii, figs. 18, 19.
„ „ Heron-Allen and Earland, 1912, etc., NSG. 1913, No. 3, p. 274, fig. 36.

Station 47.

No specimens were observed in any of the material submitted to us for examination, but two very large and perfect specimens preserved in spirit on board ship were submitted to us for identification from official Stations 316 and 339, the latter being our Station 47. The specimen from the former Station measured 19 by 21 mm., and therefore approximates in size to the enormous specimens observed originally by Murray, and subsequently by Earland in the cold area of the Färoe Channel. The specimen from Station 339 (H.-A. & E., Station 47) is much smaller, being only 8 mm. maximum diameter.

Family ASTRORHIZIDAE.

Sub-Family ASTRORHIZINAE.

ASTRORHIZA, Sandahl.

66. *Astrorhiza limicola*, Sandahl.

Astrorhiza limicola, Sandahl, 1857, Öfvers. K. Vet. ak. Forh. vol. xiv, p. 299, pl. iii, figs. 5 and 6.
„ „ Brady, 1884, FC. p. 231, pl. xix, figs. 1–4.

Stations 26, 50.

The records depend upon two specimens from Station 50, and more doubtful individuals from Stations 26 and 55.

67. *Astrorhiza arenaria*, Norman.

Astrorhiza arenaria (Carpenter MS.), Norman, 1876, Proc. Roy. Soc., vol. xxv, p. 213.
„ „ Brady, 1884, FC. p. 232, pl. xix, figs. 5–10.

Stations 6, 40.

A few individuals from Station 6, characterized by the very large size of the sand-grains, and the loose manner in which they are agglutinated. In one specimen the radiating pseudopodia have been preserved with sand-grains attached as though in the act of gathering material for addition to its test. The Antarctic record rests on a somewhat doubtful specimen.

IRIDIA, Heron-Allen and Earland.

68. *Iridia diaphana*, Heron-Allen and Earland.

Thurammina papillata (?) Earland, 1905, FBS. p. 201, pl. xi, figs. 6, 7; pl. xiv, figs. 1–3.
Webbina hemispherica, Heron-Allen and Earland, 1908, etc., SB. 1909, p. 325, pl. xv, fig. 14.
Iridia diaphana, Heron-Allen and Earland, 1914, etc., FKA. 1914, p. 371, pl. xxxvi, 1915, p. 607.
„ „ Heron-Allen and Earland, 1916, FSC. p. 37.
„ „ (*Placopsilina intermedia*, Halkyard), Halkyard, 1919, BMB. p. 26, pl. i. fig. 8; (*Placopsilina aggregata*. Halkyard) Ibid., p. 27, pl. viii, figs. 3, 4.

Stations 3, 4, 6, 26, 38, 47, 48, 50, 53 (+ D.).

To this organism we attach great biological importance, having regard to the fact that it is probably a representative of the earliest and most elementary marine Rhizopods. Our views and deductions, so far as they have gone already, may be found in the works referred to in the above synonymy. We have suggested that it is of world-wide distribution, and its reappearance in these southern latitudes adds force to our observations.

It occurs in both areas, the best N.Z., at Station 6, where many large and typical examples occur. Also abundant specimens of a small hemispherical chitinous form, very closely resembling the early Selsey examples, originally referred by us to *Webbina hemispherica*, but with a pronounced aperture at the side near the attached edge. These individuals may probably represent a local form of the initial stage. In the Antarctic the best individuals occurred at Stations 47, 48, and 53, smaller than the N.Z. specimens, excepting at Station 47, but quite typical, and exhibiting the chitinous floor admirably. At Station 26 a single example with a test constructed of very fine mud.

VANHOEFFENELLA, Rhumbler.

69. *Vanhoeffenella gaussii*, Rhumbler. Pl. I, Figs. 14, 15.

Vanhoeffenella gaussii, Rhumbler, 1905, MP. p. 105, fig. 9.
,, ,, Rhumbler, 1909, FPE. p. 216, fig. 57.
,, ,, Heron-Allen and Earland, Proc. Zool. Soc. Lond., 1915, p. 296.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 608.
,, ,, Heron-Allen and Earland, 1916, FSC. p. 37.

In a small jar containing muddy sand, without any label or identifiable particulars beyond the unquestionable fact that the material was from the Antarctic, and, judging by the size of the sand-grains, from comparatively shallow water, were found two perfect individuals of this species. This "find" proved of exceptional interest to us because a careful examination of the specimens has removed any lingering doubts which we might have had as to the identity of *Vanhoeffenella* with *Iridia*. They are essentially distinct. Under a high magnification the angular framework supporting the characteristic chitinous membrane which forms the two faces of *Vanhoeffenella* is seen to be a hollow tube with labyrinthic interior, constructed of minute Diatom and mineral débris. At each angular point of the frame there is an external opening from which the dried protoplasm is seen in both specimens to be exuded. The large mass of the protoplasmic body is, however, as in Rhumbler's figure, collected into a rounded, or oval, nodule in the centre of the cavity between the chitinous sides.

In the absence of details as to locality this jar of material was not systematically examined.

PELOSINA, Brady.

70. *Pelosina variabilis*, Brady.

Pelosina variabilis, Brady, 1879, etc., RRC. 1879, p. 30, pl. iii, figs. 1–3.
„ „ Heron-Allen and Earland, 1916, FWS. p. 218.

Stations 2, 55.

A few doubtful, small specimens at Station 2. In the Antarctic a very good example at Station 55.

71. *Pelosina rotundata*, Brady.

Pelosina rotundata, Brady, 1879, etc., RRC. 1879, p. 31, pl. iii, figs. 4, 5; 1884, FC. p. 236. pl. xxv, figs. 18–20.
„ „ Millett, 1898, etc., FM. 1899, p. 249, pl. iv, fig. 1.

Stations 46, 50, 55.

Confined to the Antarctic. A small individual at Station 46, presenting a tubular chitinous neck; large and more typical at Stations 53 and 55, but oval in shape and without the produced neck, resembling in shape and surface-construction the figures of *P. arctica*, Awerinzew (Sibirischen Eismeer, 1911, Mém. Ac. Imp. Sci. St. Petersburg. Ser. 8, vol. xxix, No. 3, p. 7, pl. 0, figs. 7, 8.)

72. *Pelosina cylindrica*, Brady.

Pelosina cylindrica, Brady, 1884, FC. p. 236, pl. xxvi, figs. 1–6.
„ „ Cushman, 1910, etc., FNP. 1910, p. 46, figs. 50, 51.

Stations 38, 48 (+ D.).

Confined to the Antarctic. One good specimen at Station 38, and a very large one at Station 48.

STORTHOSPHAERA, Schulze.

73. *Storthosphaera albida*, Schulze.

Storthosphæra albida, Schulze, 1874, R. p. 113, pl. ii, fig. 9 *a–d*.
„ „ Brady, 1884, FC. p. 241, pl. xxv, figs. 15–17.

Station 6.

The species is represented by a single specimen. In this, the external corrugations characteristic of the genus are but weakly developed, and the general appearance of the test is strongly suggestive of an affinity with *Crithionina rugosa*, Goës (G. 1896, DOA. p. 24, pl. ii, figs. 3, 4).

Although *S. albida*, as seen in Schulze's figures and in typical specimens from the deep areas of the North Sea, is a very distinctive form, it differs but very slightly from the later established genus *Crithionina*. The principal distinctions are the comparatively large size of the internal cavity in *Storthosphaera*, and the thinness of the investing wall, coupled with the corrugated exterior, but Pearcey's species, *S. depressa* (P., 1900, RCA. p. 37, pl. 1, fig. 1, *a–c*), appears to us to form a connecting link between the two genera. Owing to the rarity or absence of the external corrugations, the rougher construction of the test, and the decrease

in the size of the internal cavity, it represents a form midway between *S. albida* and *Crithionina granum*, Goës, and it becomes a question whether Goës's generic name should not be abandoned in favour of Schulze's earlier creation.

DENDRONINA, nov. gen.

Test sessile or free, unseptate, built of fine mud, sand-grains and sponge-spicules, agglutinated with varying proportions of cement and furnished with an internal or external chitinous membrane.

Initial portion of sessile specimens either a depressed amoebiform basal pad, with ramifying passages converging to a central cavity, or a more or less turgid basal chamber, with simple or labyrinthic cavity. From the basal pad or chamber rise one or more tubular outgrowths, simple or branching, diminishing in diameter towards the terminal apertures.

In free-growing specimens the basal portion is bulbous with entire or labyrinthic cavity, often of large size, from which arise one or more tubular outgrowths developing as in the sessile form.

Very fragile in the dry condition, but probably more or less flexible in the living state.

The "Terra Nova" material furnishes representatives of this new genus of Astrorhizidae, which forms a connecting link between *Masonella*, Brady, and *Dendrophrya*, Strethill Wright. Its affinities with the former are shown by the labyrinthic structure of the basal pad, and with the latter by its unseptate tubular extensions and the occurrence of specimens showing only rudimentary labyrinthic structure.

Two distinct species occur in the New Zealand area, which are replaced in the Antarctic by two varieties of simpler structure, and less striking development. We have fragments of what appears to be a similar organism from Mauritius, and the genus may prove eventually to have a wide distribution.

74. *Dendronina arborescens*, sp. nov. Pl. II, figs. 10–12, 14–18.

Stations 2, 3, 4, 6.

Organism usually sessile, but sometimes free; unseptate; arborescent; commencing in the sessile form with a basal pad of irregular shape, attached to stones, sponges and other bodies, and, in the free form, with a more or less bulbous thin-walled chamber of large dimensions. From the basal pad or bulb arise one or more hollow unseptate and thick-walled trunks of varying lengths and proportions, constructed of fine grey mud, sand, and sponge-spicules with a considerable proportion of cement. The sponge-spicules are regularly laid with their long axes parallel to the line of growth of the trunk, which furcates at irregular intervals into branches of diminishing size. Surface-walls of basal pad, trunk and branches smooth, either matt or exhibiting a glaze due to the presence of a

thin external chitinous membrane. Apertures terminal, simple or furnished with a radiating corona of spicules. Very brittle when dry, but probably more or less flexible in the living state. No perfect specimens were received.

The basal pad (Fig. 12A) is normally composed of fine grey mud and acicular spicules, both entire and broken. The spicules are arranged with some regularity, converging towards the raised centre of the pad from which the main trunk arises. When attached to a plane surface the basal pad is amoeboid in outline, but otherwise it conforms to the contour of the host. It is easily detached, and when mounted in balsam (Fig. 17) exhibits a number of branching tubes, originating in one or more central cavities and radiating, as in *Masonella*, towards the edges of the pad, but having no visible external apertures.

These basal cavities are sometimes, but not always, visible when the under surface of a detached pad is examined. It seems probable that the specimens thus exhibiting the basal cavity have become broken in detachment, leaving the floor of the basal pad attached to the host.

From the central cavities of the pad originates the hollow trunk (Fig. 12B) which rises from the pad and varies greatly in appearance. More than one trunk may rise from the same pad (Fig. 12C). Normally the trunk takes the form of a thick-walled tube, gradually diminishing in diameter and furcating at irregular intervals, each branch again dividing into smaller branchlets (Fig. 12E), but remaining unseptate throughout (Fig. 18).

The trunk may, however, terminate while still unbranched (Fig. 12C), ending with a terminal crown of radiating sponge-spicules which no doubt serve as supports for pseudopodial extensions, as in *Marsipella cylindrica*, *Haliphysema tumanowiczii*, and other species. A similar terminal appendage may occur on a side branch after furcation of the main trunk (Fig. 12D).

No complete branching specimens have been found presenting an unbroken terminal extremity, and the nature of the orifice at the end of the small branchlets remains to some extent problematical. They may end in a simple constricted aperture, but it is more probable that they terminate in a more or less loosely agglomerated and radiating crown of projecting spicules, as does *Marsipella cylindrica*, which is of about the same diameter. There can be no doubt that the extraordinary terminal fragment (Fig. 12F) reproduced in our plate belonged to our species, but the proportion of spicules to cement is higher than was observed in any other fragment, and it must be regarded as abnormal.

A certain number of basal portions have been found which exhibit little or no evidence of a sessile condition and which show signs of modification of structure as a result. Whether the organism ever exists in an entirely free condition is uncertain. Most of the specimens suggest attachment in some form or other, if only to loose sand. In one instance the test is attached to the free tube of an Annelid, and probably started its growth later than the worm.

These free or semi-free specimens differ from the fixed type in the shape of the initial portion which, instead of being an outspreading pad, takes the form of an irregular bulb with comparatively thin walls and a large internal cavity (Figs. 11, 16). The cavity is usually undivided, but is sometimes filled with a labyrinthic agglomeration of large sand-grains, the interspaces of which are probably homologous with the branching passages in the basal pad of the sessile form.

The external wall of the bulb is often furnished with projecting spicules (Fig. 16), which may serve the purpose of anchoring the bulb in an upright position in the mud of the sea-bottom. Occasionally there are accessory simple orifices on short tubular outgrowths. The proportion of spicules to grey mud and cement is noticeably less in the early stages of the bulbous form than in the sessile type.

Following the bulbous initial portion the plan of growth follows the normal plan, the trunk rapidly diminishing in diameter to the first furcation and the proportion of spicular material simultaneously increasing (Fig. 11).

There can be no doubt as to the affinities of this striking species. The unseptate columnar tube and the branching passages of the basal pad mark it unquestionably as an Astrorhizid, and, except in the existence of this specialised base and the neat construction of the test, our species is evidently closely allied to *Dendrophrya erecta*, Strethill Wright. The structure of the basal pad so closely resembles *Masonella* as to indicate that the genus forms a connecting link between the genera *Astrorhiza*, *Masonella*, and *Dendrophrya*.

The species occurs only in material from the New Zealand area, but is probably abundant in suitable localities. A considerable number of fragments have been found, but no perfect specimens, owing to the character of the material. The largest number of fragments were obtained at Station 6.

At Station 4 the spicules were abnormally large as compared with the diameter of the branches into which they were built (Fig. 14). In one fragment, from Station 6, the spicules are arranged spirally (Fig. 15), as in *Marsipella spiralis*, H.-A. & E., thus departing from the normal method of inlaying them parallel to the axis of the branch.

Size.—The maximum height of a perfect specimen can only be estimated, but probably it may attain 5 or 6 mm. The basal pad of sessile specimens ranges up to 2 mm. in diameter, and the bulbous base of free specimens up to 1·30 mm. The tubes vary between ·10 and ·70 mm. external diameter, according to their proximity to the base.

75. *Dendronina arborescens*, var. *antarctica*, nov. Pl. II, figs. 13, 19.

Basal pad small, labyrinthic, surmounted by a short, stout trunk roughly constructed of sand-grains, spicules and cement. Surface smoothly finished. Colour dark grey, due to the minerals incorporated in the cement.

This variety is based on two specimens only, one each from Stations 45 and 55. They are both sessile organisms, but detached from the host and exhibiting a labyrinthic structure of the base, as in *D. limosa*, var. *humilis*. Both are fragmentary, inasmuch as they terminate abruptly at the trunk stage; but one of the specimens (Fig. 19) exhibits a broadening at the point of fracture, which probably indicates a branching of the trunk.

In their construction and appearance they appear to be more clearly allied to the New Zealand form, *D. arborescens*, than to the Antarctic *D. limosa*, var. *humilis*.

Dimensions of the two specimens are as follows:—

Basal pad, ·70 and 1·0 mm. diameter. Height of trunk to point of fracture, 1·0 and 2·10 mm.; breadth of trunk, ·30 and ·40 mm.

76. *Dendronina limosa*, sp. nov. Pl. II, figs. 1–6.

Test sessile or free, consisting of a swollen basal chamber with entire or labyrinthic cavity. From the basal chamber arise one or more tubular extensions, unseptate and of gradually diminishing diameter. The tubes are usually simple, but a single instance of furcation has been observed. Aperture terminal and simple, formed by the constriction of the terminal end of the tube. Test constructed of fine mud and sand-grains with little cement, surface rather rough, colour yellowish grey. Walls of basal chamber and tube rather thin, much thinner than in *D. arborescens*, with the result that the bore of the tube is considerably larger than in that species. No spicules are employed in the construction of the test, and the organism is in consequence very fragile, though possibly more or less flexible in the living state. In some apparently free-growing specimens the basal chamber is surrounded with a cheval-de-frise of projecting spicules (Figs. 2, 3). It is possible that these may have been incorporated for anchoring purposes, but it is more probable that the specimens were loosely attached to a living sponge.

Confined to the New Zealand area, where it occurs in company with *D. arborescens*. It may be regarded as a primitive type of the genus. Owing to its extreme fragility the specimens are in a less perfect condition than the types of that species, but it is probably equally abundant under suitable conditions.

Size:—The basal chamber in both free and sessile specimens ranges up to 1·20 mm. Maximum height unknown, but probably does not exceed 2 or 3 mm. Thickness of wall varies from ·12 mm. at the base to ·03 mm. at the extremities of the tubes, which average ·30 mm. in diameter.

77. *Dendronina limosa*, var. *humilis*, nov. Pl. II, figs. 7–9.

Station 26.

Test sessile, composed of fine sand-grains and a little cement, but without incorporated sponge-spicules. Consisting of a basal portion with labyrinthic

interior, surmounted by a single stout columnar trunk or tube, but slightly smaller in diameter than the basal portion, passing into a simple tube and terminating abruptly in a constricted nipple-shaped aperture. Colour dark grey. Walls thin and smooth, but unpolished.

The specimens found were detached but had originally been sessile on some other body. The labyrinthic structure of the base was in all cases exposed, and as the specimens showed no signs of wear or disruption, it would appear that the organism is very loosely attached to its host, and that there is no pavement-layer separating the protoplasm from the surface of the host, such as is present in *D. arborescens*, other than perhaps such a chitinous film as occurs in *Iridia*.

The affinities are clearly with *D. limosa*, in fact the Antarctic variety closely resembles young individuals of that species from the New Zealand area, except in its markedly labyrinthic base, and its more depressed habit and massive construction.

Size :—The base ranges from ·70–1 mm. in diameter, and the maximum height is about the same. The tube averages ·20–·40 mm. in diameter.

Sub-Family PILULININAE.

BATHYSIPHON, Sars.

78. *Bathysiphon filiformis*, M. Sars (M.S.).

Bathysiphon filiformis, G. O. Sars, 1871, Vidensk.-Selsk. Forhandl., p. 251.
„ „ Brady, 1884, FC. p. 248, pl. xxvi, figs. 15–20.
„ „ de Folin, 1887, B. p. 279, pl. vi, figs. 4 *a–e*.

Station 29.

Two fragments referable to this species. It is possible that the two doubtful specimens referred to *B. argenteus* should be referred to this species.

79. *Bathysiphon rufum*, de Folin.

Bathysiphon rufum, de Folin, 1887, B. p. 283, pl. vi, figs. 8 *a–c*.

Station 40.

A few individuals characterized by a light colouring which deepens into orange bands at points marking slight constrictions in the shell.

80. *Bathysiphon argenteus*, Heron-Allen and Earland.

Bathysiphon argenteus, Heron-Allen and Earland, 1913, CI. pl. iii, figs. 1–3 ; 1916, FWS., p. 218.

Stations 2, 42, 43, 44.

The records depend upon an undoubted specimen from Station 2 (N.Z.), and a similar one from Station 44. At Stations 42 and 43 were found fragments which are less distinctive but are probably referable to this species.

Sub-family SACCAMMININAE.

PSAMMOSPHAERA, Schulze.

81. *Psammosphaera fusca*, Schulze. Pl. I, fig. 18.

Psammosphaera fusca, Schulze, 1874, R. p. 113, pl. ii, fig. 8.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 609.

Stations 1–3, 6–10, 16, 18, 21–25, 27, 29–33, 36, 37, 41, 42, 45, 47, 48, 50, 51, 53–55 (+ T. d. F., D.).

Almost universally distributed. The best N.Z., at Station 6, where it is abundant and presents the entire range of variation described and figured in our 1913 paper (H.-A. & E., 1912, etc., NSG. 1913, p. 1, pls. i–iii), from large, spherical, roughly-built free specimens, down to sessile individuals entirely composed of the finest mud. One individual deserves especial remark, sessile, low-domed, constructed of coarse sand-grains, but having three radiating tubules of fine sand, extending to some distance from the edge. At Stations 2 and 3 (N.Z.), and 53 and 55 (Antarctic) the large free spherical forms, in many instances, have a long sponge-spicule built into the edge of the wall and projecting, but not traversing the central cavity as in *P. parva*. The best Antarctic series were obtained at Stations 29 and 50, large and very rough; at Stations 21 and 32, the only Antarctic sessile specimens.

82. *Psammosphaera fusca*, var. *testacea*, Flint.

Psammosphaera fusca, var. *testacea*, Flint, 1899, RFA. p. 268, pl. viii, fig. 2.
,, ,, ,, ,, Heron-Allen and Earland, 1912, etc., NSG. 1913, p. 18, pl. ii, fig. 9.

Station 6.

A few typical specimens of this doubtfully separable species.

83. *Psammosphaera parva*, Flint.

Psammosphaera fusca, de Folin, 1895, SRR. p. 16, pl. O, figs. 4, 5.
,, *parva*, Flint, 1899, RFA. p. 268, pl. ix, fig. 1.
,, ,, Heron-Allen and Earland, 1912, etc., NSG. 1913, p. 17, pl. ii, figs. 7, 8,

Stations 2, 15, 32, 40.

The records are few, and none of the specimens are very distinctive.

84. *Psammosphaera bowmanni*, Heron-Allen and Earland.

Psammosphaera bowmanni, Heron-Allen and Earland, 1912, etc., NSG. 1912, p. 385, pl. v, figs. 5, 6, pl. vi, fig. 5; 1913, CI. p. 39; 1916, FWS. p. 219.
,, ,, Cushman, 1918, etc., FAO, p. 36, pl. ix, figs. 5, 6; pl. x, fig. 5.

Stations 3, 6.

It is of great interest to us to record the presence of this interesting form from a new area. Three specimens occur, one at Station 6, quite typical,

differing only from the British specimens in that the cement is white and calcareous, and thus contrasts sharply with the dark mineral flakes composing the test. In two others, at Station 3, which are less typical, short, broken sponge-spicules being used to form the rough framework, the "windows" being filled in with flat mineral flakes. They represent a passage-form between *P. rustica* and *P. bowmanni*.

85. *Psammosphaera rustica*, Heron-Allen and Earland.

Psammosphaera rustica, Heron-Allen and Earland, 1912, etc., NSG. 1912, p. 383, pl. v, figs. 3, 4; pl. vi, figs. 2–4; H.-A. 1915, RPF. p. 268.
,, ,, Cushman, 1918, etc., FAO, p. 37, pl. v, figs. 3, 4; pl. vi, figs. 2–4.

Stations 2, 3, 6, 41, 55.

Occurs in both areas. In the N.Z. the most abundant at Station 6. All the N.Z. specimens are of rougher construction than the British, in many cases sand-grains are utilised almost as much as spicules, and the projecting "scaffold" spicules are, to a large extent, suppressed, but in a few instances, notably at Station 6, these projecting spicules are very prominent, and the specimens are typical. In the Antarctic area the records are few. At Station 41, both sand and spicules are used, but the formation is otherwise typical. At Station 55 a single very large example, in which the projecting spicules are very large and numerous, radiating in all directions. At Station 2 a single large association of individuals such as is not uncommon in the North Sea, but without projecting scaffolding. It seems possible that Cushman's *Rhabdammina cornuta*, var. *spiculotesta* (C., 1918, FAO, p. 18, no fig.), may be founded upon similar associations, but in the absence of a figure we are not prepared to go further than this.

SOROSPHAERA, Brady.

86. *Sorosphaera confusa*, Brady.

Sorosphaera confusa, Brady, 1879, etc., RRC. 1879, p. 28, pl. iv, figs. 18, 19; 1884, FC. p. 251, pl. xviii, figs. 9, 10.

Station 26.

The specimen is not satisfactory, but should, we think, be attributed to this species, if, indeed, the genus be allowed to stand. The records depend upon Brady's "Challenger" Report, and a specimen recorded by Cushman from the Atlantic in 1,467 fms., which he notes as "very typical" (C., 1918, etc., FAO, p. 39, pl. xv, figs. 4, 5). Pearcey also records it from the Weddell Sea in the Antarctic.

We have always had some doubts as to the validity of this genus, and an examination of Brady's type-specimen, apparently the one represented by Fig. 10. (*ut supra*), in the British Museum, satisfies us that this specimen at any rate, is nothing more than an association of individuals of *Thurammina papillata*, var. *cariosa*, Flint, such as we have referred to in our paper on that genus

(H.-A. & E., 1912, etc., NSG. No. 5, 1917, p. 550, pl. xxix, figs. 1–11). Until all Brady's specimens have been found and identified the question of *Sorosphaera* must remain in abeyance, but it seems highly probable that it represents merely agglomerated associations of different varieties of *Thurammina*, such as we have figured (*loc. cit.*) on pl. xxx, under the name *T. papillata*, var. *canaliculata*, Haeusler, and var. *elegantissima*, Haeusler.

SACCAMMINA, M. Sars.

87. *Saccammina sphaerica*, M. Sars. Pl. I, fig. 16

Saccammina sphaerica, M. Sars, 1868, LUHD, p. 248.
,, ,, Cushman, 1910, etc., FNP. 1910, p. 39, figs. 33–36.

Stations 2, 7, 26, 29, 33, 40, 50, 53, 55.

The records are few, but the specimens are very good, the largest and best at Station 2. Other large individuals at Stations 29, 40 and 55. At Station 53, two specimens of the roughly constructed, wide-mouthed and spiculiferous form figured in our paper (NSG. No. 2, 1913, pl. i, figs. 15-19), for which Cushman proposes the varietal name *anglica* (C., 1918, FAO, p. 45). At Station 50, a very small specimen with neatly constructed tubular mouth resembling Rhumbler's *S. minuta* (R., 1909, etc., FPE. 1909 (1911), pl. i, figs. 8, 9; 1913, p. 375. See C., 1918, FAO, p. 46, pl. 20, fig. 5.) We figure an abnormal specimen from Station 2. It apparently represents a malformed and broken *Saccammina*, in the broken cavity of which is a mass of protoplasm and metaplastic bodies which protrudes through the aperture of the *Saccammina* and extends in an unseptate tube constructed of fine mud and cement (*Cf.* Rhumbler, 1884, Zeitschr. wiss. Zool., vol. lvii, p. 489, pl. xxii, figs. 23-24a). The specimen, including tube, measures 7 mm.

Sub-Family RHABDAMMININAE.

JACULELLA, Brady.

88. *Jaculella acuta*, Brady. Pl. I, figs. 19, 20.

Jaculella acuta, 1879, etc., RRC. 1879, p. 35, pl. iii. figs. 12, 13.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 609.

Stations 6, 29.

The records depend on a single Station in each area. At Station 6 a series of individuals was found ranging up to 10 mm. in length, presenting very marked idiosyncrasies in their construction. The outer wall of the test is built up of a firmly agglutinated crust of relatively small sand-grains, incorporated with ferruginous cement to form a comparatively smooth wall, dark in colour owing to the large proportion of heavy minerals built in. At the terminal portion of the test a mass of very loosely aggregated clear siliceous sand-grains, larger than those employed in the construction of the wall, is heaped together without any investing wall. So far as can be judged in the absence of sections, it appears

that these N.Z. specimens have the interior of the cone filled with this loosely aggregated mass. It would thus seem that *Jaculella*, in constructing its test, utilises the heavy minerals selected from its environmental material, for wall-building only. Two forms showing this method of construction are found, one with a pointed base, the other with a bulbous proloculum. No doubt these represent the megalospheric and microspheric forms.

In the Antarctic the species is represented by a single typical example of coarse construction, resembling Brady's fig. 14 (1884, F.C. pl. xxii).

89. *Jaculella obtusa*, Brady.

Jaculella obtusa, Brady, 1882, FKE. p. 714; 1884, FC. p. 256, pls. xxii, fig. 19–22.
„ „ Goës, 1894, ASF. p. 20, pl. iv, figs. 87–89; pl. v, figs. 90, 91.

Station 6, 13, 32 (+ D.).

Good and typical specimens, one of great length from Station 32.

HYPERAMMINA, Brady.

90. *Hyperammina vagans*, Brady.

Hyperammina vagans, Brady, 1879, RRC. etc., 1879, p. 33, pl. v, fig. 3.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 610.

Stations 1–3, 6, 16, 25, 26, 29, 32, 37, 38, 49 50, 55.

The best examples at Stations 6 (N.Z.) 29 and 14 (Antarctic). Other good specimens at Stations 32 and 35. At the remaining Stations the species is represented by more or less unquestionable fragments.

91. *Hyperammina ramosa*, Brady. Pl. I, fig. 13.

Hyperammina ramosa, Brady, 1879, etc., RRC. 1879, p. 33, pl. iii, figs. 14, 15.
Saccorhiza „ Cushman, 1910, etc., FNP. 1910, p. 65, fig. 81.

Stations 3, 6, 7, 9, 10, 25, 28, 29, 32, 33, 40, 41, 48, 55.

Usually occurring in fragments, but often in considerable abundance. The method of construction varies according to the nature of the bottom deposit. Where sponge-spicules are available the species has a marked tendency to incorporate these, projecting from its test. This habit is well shown at Stations 6 and 29. At other Stations the test is built of sand-grains usually somewhat roughly. At Station 10 the specimens were entirely constructed of *Globigerinæ* and other Foraminifera, which is startling, regard being had to the depth as given on the label (see our note on the material). At Station 28, where the specimens were otherwise normal, one large fragment was found in which the apertural ends were blocked up with sandy mud incorporating young megalospheric individuals of *Cornuspira involvens* to the number of at least twenty. This appears to us to be accounted for only, if the *Hyperammina* were ingesting

mud for building purposes on the precise spot where a young brood of *C. involvens* had just been hatched out. The record of the species at this Station rests entirely on these individuals.

92. *Hyperammina arborescens*, Norman.

Psammatodendron arborescens (Norman MS.), Brady, 1881, HNPE. p. 98, No. 13.
Hyperammina ,, Brady, 1884, FC. p. 262, pl. xxviii, figs. 12, 13 (fig. 10, p. 263).

Station 48.

A single recognisable branching fragment.

93. *Hyperammina elongata*, Brady. Pl. I, fig. 21.

Hyperammina elongata, Brady, 1878, RRNP. p. 433, pl. xx, fig. 2*a*, *b*.
,, ,, Cushman, 1910, etc., FNP. 1910, p. 60, figs. 73, 74.

Stations 6, 22, 26, 27, 37, 41, 52, 55 (+ D.).

Two distinct types of structure occur among the specimens referable to this species. The normal, in which the test is built up of sand-grains firmly cemented together and with more cement than is found in any other species of *Hyperammina*; the outer surface is at times quite rough, at others smoothly agglutinated. The other type utilises spicules, sometimes in part, and sometimes *in toto*, in the construction of its test, and occasionally these spicules are arranged in two distinct layers set longitudinally and transversely with a neatness equal to that displayed by *Technitella* (*Cf.* H.-A. & E., 1912, etc. NSG. 1912, p. 382, pl. v, figs. 1, 2). At Station 6, where the species is most abundant, both types occur, and the specimens also fall into two distinct groups in each type—a long, narrow tube agreeing with Brady's figures, and a short and much more massively built organism, which at times evidently attains a considerable size. The arenaceous type occurs alone at Stations 26, 27, 37, and 41, all of the small and slender type. At Stations 52 and 55 the spiculiferous type occurs alone, but using sand-grains in about equal proportions to the spicules.

This spiculiferous habit, although more predominant among the N.Z. specimens than we have observed elsewhere, is not confined to the N.Z. area; we have identical specimens from several deep-water Stations round the British coast, and it may be noted with interest that Brady's type-slide of the species in the British Museum contains a similar specimen, although he makes no reference to the habit in his published description. This spiculiferous habit extends to all the other species of *Hyperammina*, notably to *H. ramosa*, which invariably uses spicules if they are attainable. *H. mestayeri*, Cushman (C. 1919, RFNZ. p. 596, pl. lxxiv, fig. 3) from the N.Z. area—which the author states is evidently related to *H. friabilis*, Brady—no doubt occupies the same position with regard to that species that our spicular variety of *H. elongata* does to the normal type, and the habit is not confined to the N.Z. area, as we have spicular

H. friabilis from the N. Sea (330 m. "Goldseeker" Station ix, B.). De Folin, under the name of *Hyperamminella venusta* (de F. 1881, RRT, p. 140, and de F. 1887, RR, p. 114, fig. 9) figures the proloculum of a broken specimen from the Bay of Biscay which might have been drawn from one of the N.Z. examples of *H. elongata*.

94. *Hyperammina elongata*, var. *laevigata*, Wright.

Hyperammina elongata, var. *laevigata*, Wright, 1891, SWI. p. 466, pl. xx, fig. 1.
" " " " Cushman, 1910, etc., FNP. 1910, p. 61, fig. 75.

Stations 6, 10, 25, 29, 33, 40, 41.

Represented, as a rule, by a few specimens at each Station, generally fragmentary. At Station 10 the construction is rougher than usual, passing almost imperceptibly towards the type. At Station 25, in addition to the normal type, which is perfect but small, a minute specimen was found with a chitinous test shewing adventitious material deposited in a few patches only.

Wright appears to have been anticipated in his discovery of var. *laevigata* by Haeusler who, in 1885 (H. 1885, LAI, p. 26, pl. iii, fig. 23) figures a broken individual, and in 1890 (H. 1890, FST, p. 61, pl. ix, fig. 48) a perfect specimen, both under the name of *Ammodiscus filum*, Schmid; but the *Serpula filum* of Schmid (S. 1867, ZSW, p. 583, pl. vi, fig. 48) is quite different, obviously *Ammodiscus gordialis*, or a variety closely akin. Wright's name, therefore, stands in spite of Haeusler's anticipation, unless the fossils described by Howchin (H. 1888, ACF, p. 535, pl. viii, figs. 1, 2) under the name *H. elongata*, var. *clavatula*, prove to be identical with Wright's organism. The figures certainly bear considerable resemblance, but Howchin, who appears to have been familiar with recent specimens referable to var. *laevigata*, to which he refers as "smooth examples of *H. elongata*, Brady," differentiates his variety "by their minute dimensions, the proportionately larger size of its primordial chamber and its shorter contour," though he suggests that the latter feature may be due to the broken condition of his fossils.

95. *Hyperammina elongata*, var. *tenuissima*, nov. Pl. I, fig. 17.

Station 29.

Test finely arenaceous, smooth, polished, commencing with a bulbous primordial chamber more than twice the diameter of the tube, which is of practically even diameter throughout its entire length. Colour, pale brown.

This variety differs from Wright's var. *laevigata* (a) in the abnormal length of the tube, which in the largest fragment observed attained 1·5 mm., and (b) in the primordial chamber, which is swollen and club-shaped instead of fusiform, as in Wright's variety. Owing to its extreme fragility, probably none of the specimens found are perfect.

The specimens bear considerable resemblance to the starved form of *Webbina clavata*, which occurs in some of our North Sea dredgings, but these support the delicate tubular extension by incorporating a sponge-spicule at intervals in the side of the tube, whereas the Antarctic specimens which we are describing are entirely free.

The longest fragment measures 1·50 mm. with a maximum breadth ·04 mm. It has no proloculum. Diameter of proloculum in another specimen (broken), measuring ·97 in length, was ·09 mm.

96. *Hyperammina novae-zealandiae*, nom. nov. Pl. III, figs. 1–5.

Technitella mestayeri, Cushman, 1919, RFNZ. p. 595, pl. lxxiv, fig. 4.

Station 6.

Test free, elongate, circular in section, slightly tapering, straight tending to arcuate. Built almost entirely of sponge-spicules in two layers, the outer layer laid longitudinally, the inner transversely. The outer layer is evidently constructed subsequently to the inner layer as the oral end of the shell often exhibits the inner layer only of the last few courses of spicules laid down. Surface variable, sometimes smooth and neatly constructed, at others with the points of the spicules projecting in the direction of the proloculum. Occurring in two forms, (*a*) megalospheric, with a bulbous proloculum, followed by a constriction, or sometimes by several constrictions at intervals, (*b*) microspheric, tapering very gradually from the proloculum, which is missing in all the specimens we have observed, but must be quite small as compared with form (*a*). Form (*b*) attains twice the length of form (*a*). Interior of the test more or less sub-divided by constricted rudimentary septation, visible externally in some cases as a slight depression.

Station 6 in the N.Z. area was characterized by the abundant specimens of this curious and somewhat abnormal species. We were at first inclined to assign them to, or near, *Technitella raphanus*, Brady, but an examination of Brady's type-slide in the British Museum shows essential differences. The examination of specimens in balsam reveals the fact that the cavity of the N.Z. specimens is not monothalamous but is divided by rudimentary septa into chamberlets. This brings the form into close affinity with *H. subnodosa*, Brady, and the spiculiferous habit being found in other species of *Hyperammina* there is less reason to doubt the assignations of the N.Z. specimens to that genus. We have not observed the development of the spiculiferous habit in *H. subnodosa* to an equal extent with the other species, but specimens from S.W. Ireland (550 fms.) exhibit a tendency to incorporate spicules in large quantities, together with the sand-grains employed.

There can be very little doubt that the two small specimens described by Cushman from N.Z., under the name of *Technitella mestayeri*, represent young

individuals of our form. We regret our inability to use his specific name, but Cushman himself having employed the name *mestayeri* for another species of *Hyperammina*, the name *T. mestayeri* must lapse.

The species varies greatly in size, the megalospheric form ranging between 2 and 7 mm. in length, and the microspheric between 2 and 5 mm.

MARSIPELLA, Norman.

97. *Marsipella elongata*, Norman. Pl. III, figs. 10–12.

Marsipella elongata, Norman, 1878, H. p. 281, pl. xvi, fig. 7 (3 on the plate).
„ „ Brady, 1884, FC. p. 264, pl. xxiv, figs. 10–19.

Stations 2, 6.

Confined to the N.Z. area. At Station 2 only two specimens were found, one entirely built of sponge-spicules, the other constructed, as normally, of coarse sand-grains. At Station 6, where it was common, two very distinct forms occur, one constructed with great neatness, entirely of spicules, the other with the body of the test built of coarse sand-grains, but having produced tapering extremities entirely spicular.

The spiculiferous form is unquestionably the *Dioxeia richardi* of de Folin (de F. 1887, RR. p. 115, fig. 11 and "Sous les Mers," 1887, p. 130, fig. 17). *Trioxeia edwardsi* de Folin ("Sous les Mers," p. 130, fig. 16) appears to be nothing more than an abnormal form, presenting three apertures. Some of the N.Z. individuals are almost identical with it, and one, which we figure from Station 6, is clearly the same organism.

98. *Marsipella cylindrica*, Brady.

Marsipella cylindrica, Brady, 1882, BKE. p. 714; 1884, FC. p. 265, pl. xxiv, figs. 20–22.
„ „ Heron-Allen and Earland, 1912, etc., NSG. 1912, p. 388, pl. v, figs. 8, 9; pl. vi, figs. 8, 9.

Stations 6, 9, 13, 16, 22, 27, 29, 40, 49, 52.

Occurs in both areas most abundantly and the finest specimens at Station 6. It reaches a considerable length and is almost entirely spiculiferous. At Station 29 the individuals again use the spicular selective construction. At Stations 22, 27 and 40, sand and spicules are employed indifferently, at the remaining Stations sand only.

99. *Marsipella chapmani*, nom. nov. Pl. III, figs. 8, 9.

(?) *Marsipella cylindrica*, Chapman, 1914, FORS. p. 62, pl. ii., fig. 15.

Stations 2, 3, 6.

Test monothalamous, constructed entirely of sponge-spicules, usually unbroken, arranged with a pronounced sinistral twist. Normally slightly curved, but occasionally strongly arcuate. Tapering gradually from the initial end, which is closed

and blunt, to the other extremity, which, in all the specimens found, is more or less ragged and unfinished. The spicules are cemented neatly side by side with a very thin layer of colourless cement, the whole test glistening, owing to the exposed surfaces of the spicules, which are only one layer deep. The aboral extremity of the test presents no visible aperture, but is probably coarsely perforate, as nearly all the examples exhibit dried protoplasm projecting upon the surface from the extremity.

Abundant at Station 2, a few specimens at Station 3, and a single individual at Station 6.

Whether the organism is perfect, or merely a fragment of some larger growth, we cannot say. The ragged, unfinished ends which characterize all the specimens would at first suggest that they were broken, but on the other hand, no trace has been found of a corresponding fragment showing a finished extremity. The extrusion of protoplasm from the closed extremity exhibited by most of the specimens may perhaps indicate that the organism anchors itself to some host without becoming definitely sessile, but only one specimen affords evidence in support of this theory, where the organism is attached to the branching tube of a Zoophyte. Chapman, in his Ross Sea Paper, figures and describes (*ut supra*) a specimen which appears to us to be identical with our form and which certainly does not appear to be referable to *M. cylindrica*. He does not give the dimensions of his specimens, but unless his paper is misprinted, they must have been of enormous size, far surpassing anything we have seen—the breadth of the widest end of one of his specimens is given at 13 mm. If this is a misprint for 1·3, it brings it roughly into agreement with the size of our specimens, which we take this opportunity of associating with his name.

The size is very variable. The largest fragment measured 11·20 mm. in length, and was ·50 mm. broad at the initial end and ·80 mm. in diameter at the fractured extremity.

RHABDAMMINA, Brady.

100. *Rhabdammina abyssorum*, M. Sars.

Rhabdammina abyssorum, M. Sars, 1868, LUHD. p. 248 (*nomen nudum*).
„ „ Cushman, 1910, etc., FNP. 1910, p. 24, figs. 8–10.

Stations 6, 8, 16, 21, 22, 29, 31, 32, 34, 38, 42, 43, 52.

Fragments attributable to *Rhabdammina*, species indeterminate but almost certainly referable to *R. abyssorum*, occur at many Stations.

101. *Rhabdammina discreta*, Brady.

Rhabdopleura abyssorum, G. M. Dawson, Canad. Nat. 1870, vol. v., p. 177, figs. 6 (7 in plate).
Rhabdammina discreta, Cushman, 1910, etc., FNP. 1910, p. 27, fig. 13.

Station 6 (+ D.).

A single very large specimen, utilizing sponge-spicules. The species was figured by G. M. Dawson in 1870 (*ut supra*) as *Rhabdopleura abyssorum*, but the

genus *Rhabdammina* had been founded by Sars in 1868, and the specific name *abyssorum* had been already used for a distinct form, and Dawson's generic and specific names have therefore disappeared.

RHIZAMMINA, Brady.

102. *Rhizammina algaeformis*, Brady.

Rhizammina algaeformis Brady, 1879, etc., RRC. 1879, p. 39, pl. iv., figs. 16, 17.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 611.

Stations 3, 4, 6, 26, 27–29, 38, 40, 45, 48, 51, 53, 55.

Occurs in both areas. The best Stations are 26, 28, 38 and 55. At the last Station the best examples were obtained. There is, as usual, a very wide range in the method of construction. Some of the fragments are merely collapsible chitinous tubes with a mud coating, at others a considerable amount of rigidity is attained by agglutination of sand-grains, and, at Station 6, of minute Foraminifera.

Family LITUOLIDAE.

Sub-Family LITUOLINAE.

REOPHAX, Montfort.

103. *Reophax difflugiformis*, Brady.

Reophax difflugiformis Brady, 1879, etc., RRC. 1879, p. 51, pl. iv., fig. 3.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 612.

Stations 2, 8, 9, 13, 16, 18, 21, 22, 25, 28, 29, 32, 33–35, 40–42, 44–46, 50, 52, 55 (+ D.).

Very generally distributed, but the number of specimens usually small. In the N.Z. area it is somewhat rare, but at Station 9 a curious and interesting variety, composed of mica-plates, occurs. The specimens may be roughly differentiated into those constructed of coarse sand-grains without visible cement, and those built of fine grains with a greater or less quantity of ferruginous cement. The coarsely-constructed forms predominate and occur exclusively at the majority of Stations, but at Stations 32 and 40 both forms occur and run into one another. At Station 28 a variety occurs in which the neck is very long, sometimes twice the length of the body, constructed of very fine sand and cement. At Station 29 the same form occurs and is particularly noticeable, the delicately constructed neck projecting from a body built of larger and coarser sand-grains than usual. The southernmost specimens are perhaps larger and more robust than those from northerly Stations, noticeably so at Station 41, where the species is frequent. A globular type (*cf. Haplophragmium scruposum*, Berthelin (B. 1880, EAM. p. 21, pl. i (xxiv), fig. 1), occurs. The same form, but rather more ovate, occurs at Station 50, in company with an isomorph of *Lagena laevis*, both being

large and coarsely built. At Station 55 a large broken specimen, largely built up of spicules, is apparently referable to Cushman's *Proteonina ovata* (C. 1910, etc., FNP. 1910, p. 43, fig. 43).

[The many varied forms of this species are isomorphic with the hyaline series *Lagena apiculata* (Rss.) to *L. laevis* (Mont.).]

104. *Reophax ampullacea*, Brady.

Reophax ampullacea Brady, 1879, etc., RRC. 1881, p. 49, FC. p. 290, pl. xxx., fig. 6.

Station 40 (+ D.).

A single specimen.

[Hyaline isomorph, *Lagena laevigata* (Rss.), and associated forms.]

105. *Reophax fusiformis* (Williamson).

Proteonina fusiformis, Williamson, 1858, RFGB. p. 1, pl. i., fig. 1.
Reophax fusiformis, Heron-Allen and Earland, 1916, FWS. p. 222.
„ „ Millett, 1898, etc., FM. 1899, p. 253, pl. iv., fig. 11.

Stations 6–10, 13, 16, 25, 27, 29, 32, 38, 40, 41, 44, 47, 48, 50, 51 (+ D.).

Widely distributed, but as a rule represented by few and imperfect specimens. This is a species which frequently exhibits a selective tendency, usually for mica. It is worthy of note that Williamson's original coloured figure unconsciously records this fact. Micaceous building was observed at Station 8. At Station 29, mica and garnets are used indifferently, at Station 44 garnets only. The best specimens occur at Stations 27, 29, 32 and 40.

106. *Reophax scorpiurus*, Montfort.

Reophax scorpiurus, Montfort, 1808, CS. vol. i., p. 330, 83e genre.
„ „ Cushman, 1910, etc., FNP. 1910 p. 83, figs. 114–116.

Stations 2, 3, 6, 11, 16, 18, 25, 26, 28, 29, 33, 38, 40, 42–44, 47–54 (+ R. d. J., D.).

Generally distributed, but usually rare, increasing in abundance towards the south, the best Stations being 44, 47, 48, 50, 53 and 54. At all these Stations the specimens are very dark in colour, owing to the predominance of basaltic sand, contrasting strongly with the quartz-built specimens from the northern Stations.

107. *Reophax pilulifera*, Brady.

Reophax pilulifera, Brady, 1884, FC. p. 292, pl. xxx., figs. 18–20.
„ „ Cushman, 1910, etc., FND. 1910, p. 85, figs. 117, 118.

Station 6 (+ D.).

A single specimen with produced neck, constructed of fine sand-grains.

[Hyaline isomorph, *Nodosaria soluta*, Rss.]

108. *Reophax advena*, Cushman. Pl. III, figs. 6, 7.

Reophax advena, Cushman, 1919, RFNZ. p. 599, pl. lxxv., fig. 2.

Stations 38, 45, 47, 53, 54, 55.

At a few Antarctic Stations specimens occur of a large, coarsely constructed form, which we have ventured to refer to Cushman's species on the ground of some points of similarity, although our specimens present features which are not referred to in his description. The specimens commence with a large primordial chamber, followed by two to four chambers either in a straight line or in a curve, suggesting relationship with *Haplophragmium*. The colour varies. At the most southerly stations they are very dark owing to the constituents, but at northern stations the natural colour is seen, deep brown at the primordial, owing to the presence of cement, the colour decreasing towards the later-formed chambers.

In most of the specimens the final chamber is seen to be very loosely constructed, without much cement, the sand-grains being separated, and when this loosely constructed layer is broken, the interior of the chamber is found to be labyrinthic, but the labyrinthic structure seems to be confined to the last formed chamber whilst in process of construction, for a section through an adult shell shows that the earlier chambers are non-labyrinthic. Very young specimens consisting of only two chambers are difficult to identify, except by association with adults; in external appearance they are practically indistinguishable from double individuals of *Saccammina sphaerica*.

109. *Reophax dentaliniformis*, Brady.

Reophax dentaliniformis, Brady, 1879, etc., RRC. 1881, p. 49; 1884, FC. p. 293. pl. xxx, figs. 21, 22.
„ „ Cushman, 1910, etc., FNP. 1910, p. 87, fig. 121.

Stations 29, 38, 40, 45, 46, 49, 50, 52, 53.

Confined to the Antarctic and increasing in development and size as we proceed further south. The best specimens at Stations 49, 50 and 52, especially the last. All very dark in colour owing to the incorporation of basaltic sand.

110. *Reophax bacillaris*, Brady.

Reophax bacillaris, Brady, 1879, etc., RRC. 1881, p. 49; 1884, FC. p. 293, pl. xxx, figs. 23, 24.
„ „ Cushman, 1910, etc., FNP. 1910, p. 86, fig. 120.

Station 45.

A single typical specimen. The septation of the chambers in the earlier half of the shell is obscure, and there are only four chambers in the latter half. The aboral end is thick and rounded, and the aperture opens on the face of the last chamber, and is not produced on a neck, as in the type.

[Hyaline isomorph, *Nodosaria pauperata*, d'Orb.]

111. *Reophax longiscatiformis*, Chapman.

Reophax longiscatiformis, Chapman, 1914, FORS. p. 63, pl. iii., fig. 18.

Stations 32, 47.

Recognisable fragments of this curious isomorph of *Nodosaria longiscata*, d'Orb., at both Stations.

112. *Reophax nodulosa*, Brady.

Reophax nodulosa, Brady, 1879, etc., RRC. 1879, p. 52, pl. iv, figs. 7, 8; 1884, FC. p. 294, pl. xxxi, figs. 1–9.
„ „ Cushman, 1910, etc., FNP. 1910, p. 87, fig. 122.

Stations 23, 25, 26, 28, 29, 32, 33, 35, 37, 38, 40, 48, 55 (+ T. d. F., D.).

Confined to the Antarctic and represented as a rule by fragments. The best specimens at Station 28. At Station 29 some good specimens, which probably represent a dentaline microspheric form, characterized by a large number of chambers. They suggest *R. bacillaris*, Brady, but differ in the comparatively coarse construction of the test. At Station 37 a small specimen, consisting of three chambers, very thin-walled, almost chitinous, isomorphous with *Nodosaria soluta*.

[Hyaline isomorph, *Nodosaria farcimen* (Sold.), and allied forms.]

113. *Reophax spiculifera*, Brady.

Reophax spiculifera, Brady, 1879, etc., RRC. 1879, p. 54, pl. iv, figs. 10, 11.
„ „ Cushman, 1910, etc., FNP. 1910, p. 92, figs. 132, 133.

Stations 2, 3, 4, 6, 27, 41, 52.

At a few Stations only in both areas. The Antarctic records rest on three Stations. At Stations 41 and 53 Brady's original type occurs, very well grown. The specimens from the N.Z. area present far greater variety and indicate that they do not represent a true species but are merely spiculiferous isomorphs of various Nodosariae. They are most abundant at Station 6, where they attain a large size and range in form between isomorphs of *Nodosaria filiformis*, *communis*, and *soluta*. At this Station also the species occurs sessile and adapting itself to the contour of the object to which it is attached, isomorphous with *Nubecularia tibia*, Jones & Parker. Similar wild growing isomorphs of *N. lucifuga*, but free, occur at Station 2.

At Stations 2, 3 and 6 individuals occur with long separating stolon-tubes, referable to Cushman's var. *pseudodistans* (C. 1919, RFNZ. pl. lxxv, fig. 1), but in our opinion these would have been better described as spiculiferous specimens of *R. distans*, Brady. At Station 6 one of the individuals was sessile.

[Hyaline isomorphs, *Nodosaria communis*, d'Orb., *filiformis* (d'Orb.) and *soluta*, Rss. Porcellanous isomorphs, *Nubecularia lucifuga*, Defr. and *tibia*, J. & P.]

114. *Reophax euneta*, Jensen. Pl. III, figs. 13, 14.

Reophax euneta, Jensen, 1905, Proc. Linn. Soc., N.S.W., 1904, pt. 4, p. 821, pl. xxiii, figs. 5–7 *a*, *b*.

Station 6.

One large specimen, 5 mm. in length, characterized by abnormal accessory chambers added at the oral extremity, a smaller specimen, and two primordial chambers. The extraordinary regularity with which the spicules are laid parallel with the main axis of the test, and their perfection, renders this a most striking object. The pale brown colour is due to the cement used, which, however, is hardly visible, so small is the quantity employed. The parallel spicules give a striate appearance to the test. Some question might arise whether the spicules are selected or secreted, owing to their abnormal regularity, but an examination in balsam shows that the test is composed of two layers of spicules, the inner layer being laid transversely to the outer, and that broken spicules are utilized as well as perfect ones, especially for the inner layer. The swollen primordial chamber is a very noticeable characteristic, and the test is deeper in colour at this end. The protoplasm is dark in colour, and exists in considerable quantities in all the chambers. The general habit of the shell is generally suggestive of *Hormosina*, but for reasons stated under that genus we attribute little value to this generic differentiation.

115. *Reophax distans*, Brady.

Reophax distans, Brady, 1879, etc., RRC. 1881, p. 50 ; 1884, FC. p. 296, pl. xxxi, figs. 18–22.
,, ,, Cushman, 1910, etc., FNP. 1910, p. 85, fig. 119.

Stations 13, 15, 16, 25, 26–29, 32, 33, 35, 38, 43, 44, 45, 55 (+ D.).

Confined to the Antarctic but ranging over the whole area. Recognizable fragments are all that can be credited to many Stations, but approximately perfect specimens at Stations 27, 29, 32 and 44, at which Stations, judging from the abundance of fragments, the species must have been common.

See our note under *R. spiculifera* (var. *pseudodistans*, Cush.)

[Porcellanous isomorph, *Nubecularia tibia*, J. & P. Hyaline isomorph *Nodosaria inflexa*, Rss.]

116. *Reophax adunca*, Brady.

Reophax adunca, Brady, 1882, BKE. vol. xi., p. 715 ; 1884, FC. p. 296, pl. xxxi, figs. 23–26.
,, ,, Haeusler, 1890, FST. p. 30, pl. iii, fig. 12.

Stations 3, 6 (+ D.).

At these Stations a number of specimens of a minute *Reophax* were found. In their irregular outline and tendency to vary the line of curvature they suggest a relationship to Brady's form, to which we assign them, although they differ in their minute size from the type, which occurs abundantly in some of our deeper water British material and there attains a large size.

117. *Reophax cylindrica*, Brady.

Reophax cylindrica, Brady, 1884, FC. p. 299, pl. xxxii, figs. 7–9.
„ „ Flint, 1899, RFA. p. 274, pl. xviii, fig. 6.

Station 18.

A single perfect and one imperfect typical specimen. This appears to be a very rare form, but there is a southern record, a fragment having been found by the "Challenger" (Station 144) between the Cape of Good Hope and Kerguelen Id. (1,570 fms.). The original specimens were from deep water in the North Atlantic.

HAPLOPHRAGMIUM, Reuss.

118. *Haplophragmium agglutinans* (d'Orbigny). Pl. III, fig. 15.

Spirolina agglutinans, d'Orbigny, 1846, FFV. p. 137, pl. vii, figs. 10–12.
Haplophragmium agglutinans, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 612.

Stations 6, 7, 13, 16, 17, 29, 31, 32, 33, 35, 40, 41.

In the N.Z. area the species occurs abundantly at Station 6 in a large rough-surfaced variety closely resembling *H. coprolithiforme*, Schwager (S. 1867, ZAS. p. 654, pl. 34 (xi), fig. 3). At Station 7 a single normal specimen exhibiting the selection of magnetite, to which we have referred elsewhere (H.-A., 1915, RPF. p. 226, pl. xviii, fig. 62). In the Antarctic area the species exhibits a greater range of variation, but the general tendency is towards depauperate individuals in which the spiral chambers are reduced almost to the point of disappearance, and are followed by a long series of delicate chambers attaining frequently the number of 12 to 20, the entire test reaching a maximum length, ·55 mm. At Station 32 the depauperation is carried to such an extent that the individual chambers are separated by deep sutural depressions and terminated by a produced neck. At the same Station one of these specimens was found sessile on a sponge-spicule. At Stations 16, 33, 35 and 40 a variation occurs in the direction of *H. pseudospirale*, the later chambers becoming notably compressed.

[Hyaline isomorphs. The innumerable variations of this species can nearly all be matched in the equally large number of variations recorded for *Marginulina*. The very pauperate form met with in deep water has a hyaline isomorph in the forms figured by Terquem in his voluminous papers on the Lias of the Moselle (1858–1866). *M. sigma* is perhaps the nearest (pl. xxi, fig. 6).]

119. *Haplophragmium pseudospirale* (Williamson).

Proteonina pseudospiralis, Williamson, 1858, RFGB. p. 2, pl. i, figs. 2, 3.
Haplophragmium pseudospirale, Millett, 1898, etc., FM. 1899, p. 358.

Stations 6, 33, 36, 40.

Very few specimens in both areas. The best Antarctic specimens at Station 40,

120. *Haplophragmium calcareum*, Brady.

Haplophragmium calcareum, Brady, 1884, FC. p. 302, pl. xxxiii, figs. 5–12.
„ „ Flint, 1899, RFA. p. 275, pl. xix, fig. 1 (error for 2).

Stations 6, 10.

Only in the N.Z. area. At Station 6 it is abundant and attains a large size. The test is constructed very roughly of large sand-grains, smaller grains embedded in cement being used to fill the interstices. The aperture is a narrow slit situated at the end of a produced neck, constructed of finer material. At Station 10 a single specimen utilizing the tests of other Foraminifera as building material was found.

121. *Haplophragmium tenuimargo*, Brady.

Haplophragmium tenuimargo, Brady, 1882, BKE. vol. xi, p. 715 ; 1884, FC. p. 303, pl. xxxiii, figs. 13–16.
Ammobaculites „ Cushman, 1910, etc., FNP. 1910, p. 117, figs. 180–183.

Stations 6, 25 (+ T. d. F.).

An admirable specimen from Station 6 and a more doubtful one from Station 25.

122. *Haplophragmium fontinense*, Terquem.

Haplophragmium fontinense, Terquem, 1867, etc., FOM. 1870, p. 235 (in series), pl. xxiv, figs. 29, 30 *a*, *b*.
Ammobaculites americanus, Cushman, 1910, etc., FNP. p. 117, figs. 184, 185.

Stations 8, 40, 44 (+ D.).

Few records, but the species occurs in both areas. The N.Z. specimens are very coarsely built. Most abundant and exhibiting considerable variation at Station 40. Terquem's species is so well recognised in association with Brady's figure that we cannot agree with Cushman's erection of the well known type into a separate species under the name of *Ammobaculites americanus*, on the ground that Terquem's species is concavo-convex in section. Although Terquem refers to this in his text, his figures are clearly the same as Brady's, and give but the faintest indication of the convexity, probably not more than is indicated in Brady's figure of the species.

123. *Haplophragmium emaciatum*, Brady.

Haplophragmium emaciatum, Brady, 1884, FC. p. 305, pl. xxxiii, figs. 26–28.
„ „ Cushman, 1910, etc., FNP. 1910, p. 102, figs. 150–152.

Stations 5, 6.

This can only be regarded as a thin-walled variety of *H. canariense*, but it exhibits a striking tendency to build largely of sponge-spicules and micaceous

plates. It is recorded only from Stations 5 and 6, both of which yielded excellent specimens.

124. *Haplophragmium foliaceum*, Brady.

Haplophragmium foliaceum, Brady, 1879, etc., RRC. 1881, p. 50; 1884, FC. p. 304, pl. xxxiii, figs. 20–25.
Ammobaculites ,, Cushman, 1910, etc., FNP, 1910, p. 116, figs. 177–179.

Stations 28, 29, 32, 33, 35.

Few records, but very good specimens at Stations 28, 29, constructed of rather coarser material than is usually the case.

125. *Haplophragmium rotulatum*, Brady.

Haplophragmium rotulatum, Brady, 1879, etc., RRC. 1881, p. 50; 1884, FC. p. 306, pl. xxxiv, figs. 5, 6.
Haplophragmoides ,, Cushman, 1910, etc., FNP. 1910, p. 104, figs. 156, 157.

Stations 6, 8, 13, 32, 40.

This may be described as a *Haplophragmium* of the *canariense* type in which the umbilici are deeply sunk and the peripheral edge truncate. It occurs at a few Stations in both areas, the best at Station 6. It has a normal tendency to utilize coarse material in the construction of its test, and this takes an exaggerated form at Station 40, where the specimens are very rough.

126. *Haplophragmium latidorsatum* (Bornemann).

Nonionina latidorsata, Bornemann, 1855, FSH. p. 339, pl. xvi, fig. 4.
Haplophragmium latidorsatum, Heron-Allen and Earland, 1913, CI. p. 46, pl. ii, figs. 15, 16.
,, ,, Millett, 1898, etc., FM. 1899, p. 360.

Stations 6–8, 13, 16, 20, 21, 22–25, 28, 29, 32–36, 38, 40, 42, 44, 51 (+ T. d. F.).

Almost universally distributed but most abundant in the deep water to the S. of N.Z. It presents the usual wide range of variation in size and character of the shell-structure. At the majority of the Stations a very rough habit of construction predominates, due to the incorporation of angular sand-grains, but a smooth type built of finer material also occurs, and becomes more common as one goes south. At some Stations—23, 29, and 35—the two forms occur together.

127. *Haplophragmium scitulum*, Brady.

Haplophragmium scitulum, Brady, 1879, etc., RRC. 1881, p. 50; 1884, FC. p. 308, pl. xxxiv, figs. 11–13.
,, ,, Chapman, 1914, FORS. p. 64, pl. iii, fig. 22.

Stations 6, 10, 13, 22, 26, 29, 31, 32, 33, 38, 40, 41 ,43, 44, 51, 52 (+ K. I., R. d. J.).

Widely distributed and fairly abundant at many Antarctic Stations, but never particularly typical. The best examples at Stations 26, 29, 38 and 41.

[Hyaline isomorph, *Nonionina pompilioides* (F. & M.).]

128. *Haplophragmium glomeratum*, Brady.

Lituola glomerata, Brady, 1878, RRNP. p. 433, pl. xx, fig. 1.
Haplophragmium glomeratum, Heron-Allen and Earland, 1913, CI. p. 46, pl. ii, fig. 14.
„ „ Cushman, 1910, etc., FNP. 1910, p. 104, figs. 158–161.

Stations 16, 27, 29, 32, 33, 36, 40, 44 (+ D.).

Confined to the deeper water between N.Z. and the Antarctic coast line. The number of specimens found was always small, but they are all larger than the average, and extremely well developed.

129. *Haplophragmium canariense* (d'Orbigny).

Nonionina canariensis, d'Orbigny, 1839, FIC. p. 128, pl. ii, figs. 33, 34.
Haplophragmium canariense, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 614.

Stations 1–6, 13, 17, 26, 27, 29, 31, 33, 36, 41, 44–47, 49, 50, 52, 53–5 (+ R. d. J., D.).

Almost universally distributed, but there is a strange gap in the records between Stations 6 and 13. The species is, as everywhere, extraordinarily variable, ranging in the one direction towards *H. emaciatum* and *H. nanum*, and, in the other, towards *H. crassimargo*, the transition between these species being so gradual at some Stations as to defy diagnosis. The tendency to inflation of the chambers is noticeable, particularly at Stations 13 and 29, where the species shows a tendency to pass into the species *H. sphaeriloculum*, Cush. The largest specimens from the N.Z. area occur at Station 3, but there is a general tendency to increase of size as we go south, the Antarctic Stations yielding not only abundant specimens, but large individuals with thicker tests, passing imperceptibly at Stations 45 (which is the best Antarctic Station), 47, 50, 53, 54, 55, into *H. crassimargo*. At Stations 48, 53, and 54 the convolutions are noticeably excentric, and the tendency is to pass into *H. scitulum*. At Stations 26, 45 and 55 specimens pass imperceptibly by gradual distortion into our var. *variabilis*. Station 36 is noteworthy from the fact that though other conditions seem to be favourable, only a single minute specimen was recorded.

[Hyaline isomorph, *Nonionina depressula* (W. & J.), to *N. umbilicatula* (Mont.), and allied forms.]

130. *Haplophragmium canariense*, var. *variabilis*, Heron-Allen and Earland.

Haplophragmium canariense (d'Orb.) Heron-Allen and Earland, 1916, FWS. p. 223, pl. xl, figs. 12, 13.
„ „ var. *variabilis*, Heron-Allen and Earland, 1916, FSC. p. 41, pl. vi, figs. 1–3.

Stations 26, 38, 45, 46, 47, 48, 53, 54 (+ D.).

The records are confined to the southern areas in the Antarctic Circle. At some of the Stations, noticeably Stations 26 and 38, it attains great profusion and variety of growth, and also considerable size. Every type of malformation conceivable is represented, but perhaps the most noticeable lines of variation

are (*a*) in the reversal of the spiral of growth after a complete revolution, and (*b*) the diversion of the line of growth to a direction at right angles with that originally adopted.

[Hyaline isomorph, *Truncatulina variabilis*, d'Orb.]

131. *Haplophragmium nanum*, Brady.

Haplophragmium nanum, Brady, 1879, etc., RRC. 1881, p. 50; 1881, HNPE, p. 99, pl. ii, figs. 1 *a–c*; 1884, FC. p. 311, pl. xxxv, figs. 6–8.
Trochammina nana, Cushman, 1910, etc., FNP. 1910, p. 123, figs. 190–192.

Stations 3, 6, 13, 26, 29, 33, 45, 46, 53, 54.

This inaequilateral form of the type *H. canariense* occurs in both areas, but reaches its best development in the most southerly Stations, especially at Stations 53 and 54. It passes by imperceptible degrees into the type in one direction and by irregular growth into our variety *H. canariense*, var. *variabilis*, in the other.

[Hyaline isomorph, *Nonionina boueana*, var. *janiformis*, Rupert Jones.]

132. *Haplophragmium crassimargo*, Norman.

Haplophragmium crassimargo, Norman, 1892, Museum Normanianum, pt. viii, p. 17 (Note).
,, ,, Heron-Allen and Earland, 1910, NBF. p. 424, figs. 3, 4; 1913, FNS. p. 130, pl. x, figs. 5, 6; 1914, etc., FKA, 1915, p. 614.

Stations 26, 38, 40, 45, 46, 48, 50.

The records are confined to the Antarctic. The general increase in the size of the type species *H. canariense* as one goes south is probably connected with this distribution, *H. crassimargo* being inseparable by any specific features other than its comparatively enormous size. It is, however, a convenient taxonomical name. The best Stations are Nos. 26 and 45, at both of which it attained a very large size. The variety appears to be subject to wide abnormalities. Station 26 supplied an individual furnished with accessory chambers, developing from the umbilicus. At Station 38 a wild-growing individual isomorphous with *H. canariense*, var. *variabilis* occurs. As in the type species *H. canariense*, the Antarctic specimens are usually very dark in colour, owing to the incorporation of black mineral sand, but at Station 38 specimens of a dark red, owing to the presence of ferruginous cement and an absence of the black sand-grains, were found in company with the dark specimens.

133. *Haplophragmium sphaeriloculum* (Cushman).

Haplophragmoides sphaeriloculum, Cushman, 1910, etc., FNP. 1910, p. 107, fig. 165.
Haplophragmium ,, Sidebottom, 1918, FECA, p. 15, pl. ii, figs. 15, 16.

Stations 6, 17, 18, 22, 33.

This is merely a variety of *H. canariense*, characterized by excessive depression of the sutural lines, thus leading to a spherical inflation of the chambers.

It is a well-marked form and worth separating. Typical specimens occur in both areas, but in very limited numbers, the best at Stations 18 and 22. Seven years later Cushman (C. 1917, NFP. p. 652) uses the same specific name for what he again describes as a new species, without reference to his former paper. The description is differently worded, and in the absence of any figure it is not possible to identify the 1917 species with that of 1910, or indeed with any other specimens.

134. *Haplophragmium globigeriniforme* (Parker and Jones).

Lituola nautiloidea, var. *globigeriniformis*, Parker and Jones, 1865, NAAF. p. 407, pl. xv, figs. 46, 47; pl. xvii, figs. 96–98.
Trochammina globigeriniformis, Cushman, 1910, etc., FNP. 1910, p. 124, figs. 193–195.

Stations 1, 2, 6, 7, 10, 11, 16, 25, 27, 29, 31, 33, 35, 36, 40, 43, 44, 52, 54 (+ D.).

Generally distributed in both areas. The best and most typical specimens at Stations 6, 7, 10 (N.Z.) and 16, 29 and 54 (Ant.). At Stations 16 and 54 the specimens were exceptionally fine and large. At Station 40, all very small. At Station 10 most of the individuals were coarsely built of larger sand-grains than usual.

[Hyaline isormorphs, *Globigerina bulloides*, d'Orb., through *G. dubia*, Egger, to *G. dutertrei*, d'Orb.]

135. *Haplophragmium anceps*, Brady.

Haplophragmium anceps, Brady, 1884, FC. p. 313, pl. xxxv, figs. 12–15.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 615.

Stations 1, 2, 6, 10, 13, 33, 36, 38, 42, 43.

Common to both areas, but best represented at Station 6, where there were a great many excellent specimens characterized by an inordinately large number of chambers. The best Antarctic specimens were at Station 38. At Station 10 a good many specimens characterized by a coarse method of construction as in *H. globigeriniforme* from the same Station.

[Hyaline isomorph, the wild-growing *Textularia concava*, var. *heterostoma*, Forn., referred to in our note on that species and figured in H.-A. & E. 1920, VP. p. 161, pl. xvi, fig. 3.]

136. *Haplophragmium sphaeroidiniforme*, Brady.

Haplophragmium sphaeroidiniforme, Brady, 1884, FC. p. 313.
Ammosphaeroidina „ Cushman, 1910, etc., FND. 1910, p. 128, fig. 202.

Stations 3, 6, 7, 9, 10, 11, 12, 13, 22, 33 (+ D.).

A few individuals only from both areas, the largest specimen being the only one found at Station 6.

[Hyaline isomorph, *Sphaeroidina bulloides*, d'Orb.]

NOURIA, Heron-Allen and Earland.

137. *Nouria polymorphinoides*, Heron-Allen and Earland.

Reophax ampullacea, Millett, 1898, etc., FM. 1899, p. 253, pl. iv, fig. 9.
Nouria polymorphinoides, Heron-Allen and Earland, 1914, etc., FKA. 1914, p. 376, pl. xxxvii, figs. 1–15 ; 1915, p. 615.
,, ,, (*Reophax polymorphinoides*, Halkyard), Halkyard, 1919, BMB. p. 22, pl. i, figs. 6, 7.
,, ,, Cushman, 1919, RFNZ. p. 601, pl. lxxv, figs. 4, 5.

Station 6.

A few specimens from Station 6, differing from the Kerimba specimens, upon which the species was, in part, originally diagnosed, in the greater proportion of sponge-spicules employed in the construction of the test.

[Hyaline isomorph *Polymorphina compressa*, d'Orb.]

138. *Nouria harrisii*, Heron-Allen and Earland.

Nouria harrisii, Heron-Allen and Earland, 1914, etc., FKA. 1914, p. 376, pl. xxxvii, figs. 16–20.

Station 6.

A single typical specimen.

[Hyaline isomorph, *Polymorphina oblonga*, Will.]

PLACOPSILINA, d'Orbigny.

139. *Placopsilina cenomana*, d'Orbigny.

Placopsilina cenomana, d'Orbigny, 1850, etc., PP. vol. ii, 1850, p. 185, no. 758.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 615.

Stations 2, 3, 6, 29, 31, 32, 40, 54, 55.

Extends over the whole area, the best at Station 6 (N.Z.), and in the Antarctic at Stations 29 and 32. At both these Stations the specimens are sessile upon sponge-spicules, round which the chambers have coiled themselves. At Station 55 specimens are free and wild-growing.

[Porcellanous isomorph, *Nubecularia lucifuga*, Def.]

140. *Placopsilina kingsleyi*, Siddall.

Placopsilina kingsleyi, Siddall, 1886, LMBC. p. 54, pl. i, fig. 1.

Station 48.

At this Station a specimen, attached to a Polyzoon, and constructed of fine mud, spicules, and diatoms, resembles very closely Siddall's figure. Beyond this we are not prepared to go, as the type specimen is not to be found among the Siddall collection, which is in our possession, the specimen being absent from his type-slide.

THOLOSINA, Rhumbler.

141. *Tholosina bulla* (Brady).

Placopsilina bulla, Brady, 1879, etc., RRC. 1881, p. 51 ; 1884, FC. p. 315, pl. xxxv, figs. 16, 17.
Tholosina ,, Cushman, 1910, etc., FNP. 1910, p. 49, fig. 55.

Stations 26, 28, 38, 45, 46, 50, 53, 54, 55 (+ K. I., D.).

Attains its maximum development in the Antarctic area, where it is common, and extremely variable, attached to Zoophytes. There is a wide range in size, the finest specimens being from Station 55. Other large individuals at Stations 38 and 45. At some of the Stations where the species is abundant there is an enormous range in the shape of the individual specimens, from low sessile growths to high-domed, sub-globular, globular attached, and even (at Station 26), globular free. The latter individuals can only be determined by their association with their congeners ; taken apart they would be indistinguishable from specimens of *Thurammina papillata*, Brady. The Antarctic specimens are, as a rule, very dark in colour, owing to the character of the sand-grains, of which the test is composed. At Station 28, attached to stems of a Campanularian, the branching outgrowths from which pass right through the test of the Rhizopod, which has constructed a wall round them.

CRITHIONINA, Goës.

The genus *Crithionina*, instituted by Goës in 1894, cannot be regarded as entirely satisfactory. It probably includes several forms which, though closely related, have no definable connexion with one another. The original diagnosis of the genus is probably responsible for the resultant uncertainty as to its systematic position. Goës' definition was as follows :—" Labyrinthic, or cavernous, or with an undivided central cavity, provided with a sub-cavernous wall, with scanty or indistinct apertures." Of the species originally described, *C. granum* may be regarded as the simplest type, and forms, in its many varieties, a link connecting the other species assigned to the genus. *C. granum* in its external form may, practically, be of any shape—typically it is a compressed sphere. *C. mamilla* is, practically, always sessile, an attached hemispherical body, from the outer walls of which project spicules or shell-fragments, irregularly disposed. In both species the walls are thick, and built up of fine sand-grains, held together with a minimum of cement. In 1896 Goës added three other species to his genus, *C. pisum*, *C. rugosa*, *C. lens*, and variety *C. granum*, var. *sub-simplex*. *C. pisum*, which, in its most typical form, as commonly found in North Atlantic oozes, is a small pea-shaped (pisiform) shell, of smooth exterior, and thick wall, exhibiting, when laid open, but a small central cavity, but which tends, wherever the species occurs in any quantity, to vary in a retrograde direction, towards *C. granum*, and in a progressive direction towards *C. rugosa*, which may be regarded as

a hypertrophied condition, with a rough shell-wall. *C. lens*, on the other hand, presents internal features which differentiate it widely from the type. The central cavity is furnished with radiating extensions, projecting to within a short distance of the periphery, or—to put it in another form—the peripheral wall extends in radial flanges almost to the centre of the cavity. This feature appears to us to connect the genus with *Tholosina*, which, though normally a thin-walled subspherical shell, tends to form accessory chamberlets round the peripheral edge, which, though not visible externally, are exhibited when the shell is laid open, as in the figure given by Goës (G. 1894, ASF. pl. vi, fig. 215).

Like most of the arenaceous Foraminifera, *Crithionina*, though normally free, readily adopts a sessile habit. *C. mamilla* is rarely found in any other condition, and even the occasional free specimens with which one meets have probably become detached from a host. Nearly all the other species which occur in the gatherings are found in both free and sessile condition.

The building material used by *Crithionina*, is, as already mentioned, usually fine sand. Ferruginous cement is never employed, but there appears to be a constant tendency to incorporate sponge-spicules in the test; this tendency reaches its maximum in the variety of *C. pisum*, which was described by Flint (F. 1899, RFA. p. 267, pl. vi, fig. 2) as "var. *hispida*." *C. rugosa* in our Antarctic material tends in the same direction; at Station 38 the specimens showing this tendency are very characteristic. At Station 55 this form occurs both free and attached.

The genus is not represented in the deep water between North Cape, N.Z., and the Antarctic Continent, but is generally distributed in the shallow water gatherings of both areas.

142. *Crithionina granum*, Goës.

Crithionina granum, Goës, 1894, ASF. p. 15, pl. iii, figs. 28–33.
,, ,, Rhumbler, 1903, ZRR. p. 231, fig. 58.
,, ,, Cushman, 1918, etc., FAO. p. 69, pl. xxvi, figs. 6, 7.

Stations 3, 5, 6, 26, 38, 43, 47, 50.

Free and attached at Station 6. Large and typical at Station 38, where the specimens are of dark colour owing to the incorporation of volcanic sand.

143. *Crithionina mamilla*, Goës.

Crithionina mamilla, Goës, 1894, ASF. p. 15, pl. iii, figs. 34–36.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 616.

Stations 2, 6, 26, 29, 38, 48, 50, 55 (+ D.).

The distribution is similar to that of the other species of the genus. At Station 6 it occurs in abundance, and with considerable variety. Some of the specimens are built round large sponge-spicules traversing the mass of the shell,

others are as truly hispid as Flint's variety of *C. pisum*. In the Antarctic area specimens are not so highly developed—they are smaller and in several cases attached to large sand-grains instead of to the normal habitat of Zoophytes or Mollusca. At Station 48 the only specimen was very compressed, and without incorporated fragments or spicules. The best Antarctic specimens were from Station 38.

144. *Crithionina pisum*, Goës.

Crithionina pisum, Goës, 1896, DOA. p. 24, pl. ii, figs. 1, 2.
,, ,, Heron-Allen and Earland, 1909, TNS. p. 410, pl. xxxiv, figs. 6, *a*.
,, ,, Cushman, 1910, etc., FNP. 1910, p. 55.

Stations 2, 3, 6, 25, 26, 38, 41, 45, 47, 48, 50, 53, 54, 55.

Occurs both free and attached. At Station 38, large, and at Station 55 very large. Largest of all, sessile on sponges from Station 25, and from Official Station 294. (No material to hand.)

145. *Crithionina pisum*, var. *hispida*, Flint.

[*Technitella melo*, Norman, *fide* de Folin, 1895. SRR. p. 13, pl. 0, fig. 3.]
Crithionina pisum, var. *hispida*, Flint, 1899, RFA. p. 267, pl. vi, fig. 2.
,, ,, ,, ,, Heron-Allen and Earland, 1909, TNS. p. 410, pl. xxxiv, fig. 7.
,, ,, ,, ,, Cushman, 1910, etc., FNP. 1910, p. 56, fig. 63.

Stations 2, 6, 46.

Very fine specimens at Stations 2 and 6 (N.Z.). In the Antarctic area a single specimen.

146. *Crithionina rugosa*, Goës. Pl. IV, fig. 5

Crithionina rugosa, Goës, 1896, DOA, p. 24, pl. ii, figs. 3, 4.
,, ,, Cushman, 1910, etc., FNP. 1910, p. 53, fig. 59.

Stations 6, 38, 45, 50, 53, 55.

Much more abundant in the Antarctic than in the N.Z. area. Often attains considerable size. The colour varies; at Station 38, very dark, owing to the incorporation of volcanic sand. Both free and sessile at Stations 45 and 55. Hispid varieties isomorphous with Flint's *C. pisum*, var. *hispida*, are generally distributed, we figure one from Station 38. Others were found at Station 55. The sessile specimens, especially of the hispid form, can hardly be separated from *C. mamilla*. Goës, in his description of the species, refers to the fact that *C. rugosa* appears to be closely allied to C. *mamilla*, and it appears to us to be doubtful whether there is any valid reason for the separation of the forms. The main distinctions appear to be the smaller size and generally sessile habit of *C. mamilla*.

C. rotundata, Cushman (C. 1910, etc., FNP. 1910, p. 56, figs 64, 65), appears, to be nothing more than *C. rugosa* attaining super-normal dimensions and having a labyrinthic interior, thus connecting *C. rugosa* with *C. lens*.

147. *Crithionina lens*, Goës. Pl. IV, figs 1, 2.

Crithionina lens, Goës, 1896, DOA, p. 24, pl. ii, figs. 5–8.
„ „ Cushman, 1910, etc., FNP. 1910, p. 54, figs. 60–62.

Stations 2, 6, 46.

The finest specimens were from Stations 6 (N.Z.), where it occurs both free and attached. The sessile specimens, which were attached to sponges, are with difficulty distinguishable from *Tholosina bulla* (Brady), excepting by their comparatively large dimensions (2 mm. or more). A fine specimen sessile upon one of the stones from Station 2.

Sub-Family TROCHAMMININAE.

THURAMMINA, Brady.

148. *Thurammina papillata*, Brady.

Thurammina papillata, Brady, 1879, etc., RRC. 1879, p. 45, pl. v, figs. 4–8.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 617.

Stations 6, 8, 32, 40.

Beyond a few doubtful individuals the records stand by one typical specimen at Station 6, a small normal specimen and a sub-chitinous example, devoid of papillae, at Station 40.

[Hyaline isomorph, *Orbulina universa*, d'Orb.]

149. *Thurammina papillata*, var. *castanea*, Heron-Allen and Earland.

Thurammina papillata, var. *castanea*, Heron-Allen and Earland, 1912, etc., NSG. 1917, p. 545, pl. xxvi, figs. 14–18; pl. xxix, fig. 17.

Stations 2, 13.

One large specimen at Station 13, and a compressed form at Station 2.

150. *Thurammina papillata*, var. *favosa*, Flint.

Thurammina favosa, Flint, 1899, RFA. p. 278, pl. xxi, fig. 2.
„ *papillata*, var. *favosa*, Heron-Allen and Earland, 1912, etc., NSG. 1917, p. 549, pl. xxviii, fig. 17.

Station 50.

The record rests on a compressed but typical specimen at Station 50.

151. *Thurammina papillata*, var. *haeusleri*, Heron-Allen and Earland.

Thurammina papillata, Haeusler, 1883, ALB. (Ann. Mag. Nat. Hist.), p. 27, pl. viii, figs. 5–8, 11, 13–24; 1890, FST. pp. 46 *et seq.*, pl. vi, figs. 14, 18.
„ „ var. *haeusleri*, Heron-Allen and Earland, 1912, etc., NSG. 1917, p. 547. pl. xxviii, figs. 1–12; pl. xxix, fig. 16; pl. xxx, fig. 8.

Stations 3, 6, 45–47, 53–55.

Frequent at Station 6, rarer, but well developed at the southern Stations. At Station 47 the specimens are curiously angular in shape, approaching our var.

parallela (*loc. cit. supra*, p. 546, pl. xxvii, figs. 14–17). At Station 53 aggregated individuals near *T. tuberosa*, Haeusler (H. 1890, FST. p. 46, pl. vi, fig. 24; pl. vii, figs. 6–9. H.-A. & E. *ut supra*, p. 548, pl. xxviii, figs. 13–16). At Stations 46 and 53 specimens were built round sponge-spicules.

152. *Thurammina papillata*, var. *albicans*, Brady.

Thurammina albicans, Brady, 1879, etc., RRC. 1879, p. 46; 1884, FC. p. 323, pl. xxxvii, figs. 2–7.
,, *papillata*, var. *albicans*, Heron-Allen and Earland, 1912, etc., NSG. 1917, p. 550, pl. xxix, figs. 12–15.

Stations 2, 6, 13, 21, 38.

Many very large and typical examples at Station 6, some of them covered with minute perforations between the projecting papillae, which are very prominent. At Station 21 a specimen was found, the interior containing a compact mass of dark minerals such as we have recorded in our 1917 paper (*ut supra*), p. 551.

HORMOSINA, Brady.

153. *Hormosina globulifera*, Brady.

Hormosina globulifera, Brady, 1879, etc., RRC. 1879, p. 60, pl. iv, figs. 4, 5.
Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 617, pl. xlvi, fig. 25.

Stations 6, 25, 28, 32, 33, 41.

It appears to us that, having regard to our widened range of knowledge of the constructive variability of the arenaceous Foraminifera, the separation of *Hormosina* from *Reophax* is entirely supererogatory. There are many recognised species of *Reophax* which adopt the thin, smoothly-constructed wall upon which Brady appears solely to have erected this new genus, whilst on the other hand, any zoologist who has worked over material in which *Hormosina* is abundant is bound to recognise that the neat, thin-walled method of construction is frequently departed from, and that individuals have no hesitation in incorporating large mineral fragments and other Foraminifera into the walls of their shells. This is especially noticeable in many of our deep-water dredgings off the West coast of Scotland and Ireland, in which the so-called *H. globulifera* is abundant. In view of the widely-accepted status of the genus, however, we confine ourselves for the present to this expression of opinion by way of protest.

The records of *H. globulifera* rest upon an abundant and typical series from Station 6 in the N.Z. area, and a number of recognisable fragments and one perfect monothalamous test, similar to Brady's fig. 1 (FC. pl. xxxix), from the Antarctic area.

The N.Z. specimens call for further description. Two types occur which are clearly the megalospheric and microspheric types. The megalospheric type consists of two, or at most three, chambers of approximately equal diameter. The microspheric form runs to five, or more, chambers with a regular tapering. All

the individuals are constructed of large angular sand-grains, cemented with ferruginous cement, and usually so embedded as to present a relatively smooth contour, although in many specimens single isolated grains of larger size than usual project. The aperture is situated at the end of a produced neck constructed of very fine sand-grains with a maximum of cement, but owing to its fragility is often wanting, though its traces can always be found upon examination. There can be no doubt that Pearcey's *Reophax robustus* is referable to this species (P. 1914, SNA, p. 1006, pl. i, figs. 6–10), indeed, his figures represent the megalospheric and microspheric forms, and the produced neck, perfectly. It appears not improbable that Cushman's *R. advena* represents a closely-allied species, described from specimens in which the produced neck is lacking.

AMMODISCUS, Reuss.

154. *Ammodiscus incertus* (d'Orbigny).

Operculina incerta, d'Orbigny, 1839, FC. p. 49, pl. vi, figs. 16, 17.
Ammodiscus incertus, Cushman, 1910, etc., FNP. 1910, p. 73, fig. 95.

Stations 2, 6, 7, 26–29, 33, 40, 41, 47, 53, 55 (+ D.).

All the specimens are small except at Station 2 (N.Z.), where they are gigantic. Attached specimens at Station 6. At Station 29 the species is common and characterized by extremely neat, many-coiled individuals built with a maximum of cement. At Station 53, the largest Antarctic individual represents the species and is abnormal in the presence of a wild outgrowth on the last convolution.

[Porcellanous isomorph *Cornuspira involvens*, Rss.; Hyaline isomorph, *Spirillina vivipara*, Ehbg., closely-coiled forms. *Cf. Spirillina arenacea* in W. 1858, RFGB. p. 93.]

155. *Ammodiscus tenuis*, Brady.

Ammodiscus tenuis, Brady, 1879, etc., RRC. 1881, p. 51; 1884, FC. p. 332, pl. xxxviii, figs. 4–6.
„ *incertus* (pars), Cushman, 1910, etc., FNP. 1910, p. 75, fig. 96.

Stations 2, 5, 6, 29.

A few specimens only. The best N.Z. individuals, very large, at Station 6. One Antarctic specimen at Station 29.

[Porcellanous isomorph, *Cornuspira foliacea* (Phil.). Hyaline isomorph, *Spirillina vivipara*, Ehbg., evolute forms.]

156. *Ammodiscus mestayeri*, Cushman.

Ammodiscus mestayeri, Cushman, 1919, RFNZ. p. 597, pl. lxxiv, figs. 1, 2.

Stations 2, 5, 6.

As noted by Cushman, this form appears to be confined to the N.Z. area. It attains a very large size at Stations 2, 5, 6, especially at the last. Both the

megalospheric and microspheric forms occur. The test is constructed of coarser sand-grains than are usually employed by the genus, but its chief distinction lies in the fairly uniform diameter of the tube and its roughly circular outline, as contrasted with the compressed section of *A. tenuis*.

157. *Ammodiscus gordialis* (Jones and Parker).

Trochammina squamata gordialis, Jones and Parker, 1860, RFM. p. 304.
Ammodiscus gordialis, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 618, pl. xlvi, fig. 26.

Stations 2, 4, 6, 18, 22, 26, 27, 29, 38, 40, 45–48, 50, 54, 55 (+ K. I., D.).

More generally distributed in the Antarctic than in the N.Z. area. The best N.Z. Station was Station 6, where it occurs both free and attached. The best Antarctic Station was No. 26, where it is very common, large, free and attached. Sessile individuals were observed at Station 46 (growing on a living Pycnogonid), and at Station 55. At Stations 18 and 22 (single specimens) the test was smoothly constructed with a maximum of cement, an unusual characteristic in this species. At Station 29 a specimen occurred presenting all the characteristics of Döderlein's *Psammonyx vulcanicus* (Döderlein, 1892, Verh. Deutsch. geol. Ges. p. 145. See R. 1903, ZRR. p. 279, fig. 127 *a*, *b*), but the size is that of the normal *A. gordialis*, and does not reach the gigantic proportions recorded by Rhumbler from Japan.

158. *Ammodiscus charoides* (Jones and Parker).

Trochammina squamata charoides, Jones and Parker, 1860, RFM. p. 304.
Ammodiscus charoides, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 618.

Stations 16, 18, 20–23, 27–29, 32, 35, 36, 40, 42 (+ T. d. F.).

Exclusively confined to the Antarctic, and almost exclusively to the deepest water Stations. The best development at Station 22. Occasional large and well-developed specimens at other Stations, but on the average the individuals are much smaller than usual. This is particularly noticeable at Station 40, where the species was very common, and to a less extent at Station 29.

[Porcellanous isomorph *Cornuspira charoides*, H.-A. & E. 1914, etc., FKA. 1915, p. 593, pl. xlvi, fig. 15.]

159. *Ammodiscus shoneanus* (Siddall). Plate I, fig. 22.

Trochammina shoneana, Siddall, 1878, FRD. p. 46, figs. 1, 2.
Ammodiscus megaspira, Berthelin, 1878, FBP. p. 223 (p. 23 in reprint).
Turritella shoneana, Cushman, 1910, etc., FNP. 1910, p. 79, figs. 107–109.

Stations 2, 26, 27, 29, 38, 40, 48, 55.

A single specimen, typical, from the N.Z. area. The Antarctic records are few in number and the specimens rare, but they are, generally speaking, exceptionally well developed, particularly at Station 48. The Antarctic specimens are

more coarsely constructed and with a smaller proportion of cement than is usually the case.

It may be observed (*ut supra*) that in the same year—1878—that Siddall published this species it was very accurately described, but without a figure, by Berthelin, under the name *A. megaspira*. But in 1858 Terquem described and figured under the name *Terebralina regularis* an organism which unquestionably bears a striking resemblance to Siddall's form (T., 1858, etc., FLM. 1866 (pt. vi), p. 473, pl. xix, fig. 3). He describes his species "Coquille regulière, droite, à spire turriculée, formée de 7 tours, sensiblement égaux." As regards the rival claims of Siddall and Berthelin we give the preference to the former, his description being accompanied by a figure, and his name universally adopted by later writers. In the absence of any reference to the nature of the shell-wall by Terquem, his name, which would otherwise have considerable priority, should, we think, be disregarded.

TROCHAMMINA, Parker and Jones.

160. *Trochammina squamata*, Jones and Parker.

Trochammina squamata, Jones and Parker, 1860, RFM. p. 304, and Table.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 619.

Stations 1, 5, 6, 13, 26, 27, 31, 33, 35, 38, 40, 43, 45, 46, 48, 49, 52, 53–55 (+ T. d. F., R. d. J.).

Very generally distributed, the finest and longest series of specimens at Station 6 in the N.Z. area. Both free, and (rarely) sessile. The sessile specimens exhibit extrusions of white cement, as is the habit in *Valvulina fusca* (Will.) Very common at many of the Antarctic Stations, notably so at Station 53. Stations 27, 38 and 46 also yielded good series of tests. At Station 48 a specimen was found in which the inferior umbilical recess was filled with a mass of light-coloured cement, showing, however, no indication of any polythalamous development. This may represent the accumulation of material preparatory to the formation of a budding-off individual. At many of the Stations there is practically an imperceptible passage through this form to *T. rotaliformis*.

[Hyaline isomorph, *Discorbina vilardeboana* (d'Orb.) (?), and *Valvulina fusca* (Will.).]

161. *Trochammina ochracea* (Williamson).

Rotalina ochracea, Williamson, 1858, RFGB. p. 55, pl. iv, fig. 112, pl. v, fig. 113.
Trochammina ochracea, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 619, pl. xlvi, figs. 27, 28.

Stations 2, 5, 6, 7, 27, 29, 40, 41, 44–47, 50, 52, 47 (+ D.).

Common at many Stations, well developed at Stations 27 and 41. At Stations 2 and 6 it occurs in two forms, (*a*) the normal, and (*b*) the widely keeled variety,

which we figured from Kerimba (*ut supra*). As one gets further south the specimens increase in numbers and size. Very fine at Station 50. At Station 46 the only sessile specimen found was attached to a living Pycnogonid.

162. *Trochammina plicata* (Terquem).

Patellina plicata, Terquem, 1875, etc., APD. 1876, p. 72, pl. viii, fig. 9.
Trochammina plicata, Heron-Allen and Earland, 1914, etc., FKA, 1915, p. 619.

Station 8.

One extremely pauperate individual.

163. *Trochammina inflata* (Montagu).

Nautilus inflatus, Montagu, 1808, TB. Suppl. p. 81, pl. xviii, fig. 3.
Trochammina inflata, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 620.

Stations 6, 16, 18, 29, 36, 40 (+ D.).

Neither numerous nor typical, but the best at Stations 6 and 40. Good specimens also at Station 16.

[Hyaline isomorph, *Discorbina rugosa* (d'Orb.).]

164. *Trochammina nitida*, Brady.

Trochammina nitida, Brady, 1879, etc., RRC. 1881, p. 52; 1884, FC. p. 339, pl. xli, figs. 5, 6.
„ „ Heron-Allen and Earland, 1914, etc., FKA, 1915, p. 620.

Stations 2, 6, 8, 9, 33.

A few excellent specimens at Stations 2 and 6. Very small at Stations 8 and 9.

165. *Trochammina moniliformis*, sp. nov. Pl. III, figs. 18-23.

Station 6.

Test free, finely arenaceous, consisting of a number of swollen chambers loosely coiled in an elliptical spiral, and communicating with one another by a broad neck more than half the width of the individual chambers. Aperture large, circular, situated at the end of the tapering extremity of the chamber.

This species, based upon one or two perfect specimens and a number of fragments, probably represents one of the simplest of the Arenaceous Foraminifera. Its nearest congener would appear to be *T. proteus*, Karrer, or something between that form and the pauperate *T. coronata*, Brady. In the largest specimen which we figure it will be seen that the arrangement of the chambers is a very primitive spiral with gaps wherever the two adjacent chambers do not fit into one another. The septation is of the most primitive character, being merely strictures at intervals in what would otherwise have been merely a broad thin-walled tube. Even this rudimentary septation is not always present, for among the fragments which are unquestionably referable to this organism, is one, which we figure, exhibiting no trace of segmentation. In other specimens the chambers are more or less irregularly heaped together, although a spiral arrangement of

a rudimentary kind may still be traced, as though a bead-necklace had been dropped in an irregular heap.

The wall is constructed of the very finest mud, deeply stained with ferruginous cement, matt on the exterior surface, but smooth and polished within. The size is very variable; perfect individuals range between ·3–·6 mm. maximum diameter. Fragments only of many larger specimens. Chambers, width of tube and aperture also vary greatly in size. Some fragmentary chambers reach ·3 mm. in diameter.

166. *Trochammina uviformis*, Grzybowski. Pl. III, figs 16, 17.

Trochammina uviformis, Grzybowski, 1901, OWI. p. 65, pl. viii, figs. 1, 2. Abstract (in German) pp. 221–226 (same pl. and figs.).

Station 6.

Test free, consisting of a number of oval chambers built up of very fine sand and ferruginous cement, irregularly agglomerated, communicating by a simple aperture between successive chambers. The earliest chambers in the series are more or less spirally arranged, the later chambers show no signs of co-ordinated plan. Size variable, ranging between ·44 mm. and 1 mm. in diameter of specimens.

A few individuals only, which we have referred to Grzybowski's species, occur at this Station. They agree more or less with his figures of this species, and of his *T. mitrata* (*loc. cit.*, fig. 3), which appears to be identical, but owing to the fact that the description is written in Polish, no precise confirmation can be derived by us from his text. It would appear, however, that he compares his species in some respects with *T. coronata*, Brady. Such specimens may be regarded as arenaceous isomorphs of *Gypsina inhaerens*. The specimen Fig. 7, attributed by Karrer (K., 1865, FWS. p. 294, pl. 0, fig. 7) to *T. proteus*, apparently represents the form subsequently described by Grzybowski (*ut supra*) it differs considerably from all Karrer's other figures of the variable type *T. proteus*. At the same Station several specimens which are zoologically identical, but present certain differences. Instead of the regularly-shaped oval chambers, and the compact agglomeration, the chambers are irregular in shape, size and arrangement, and heaped together without any regular plan. They represent the wildest development of *Gypsina inhaerens*, in an arenaceous form.

167. *Trochammina trullissata*, Brady.

Trochammina trullissata, Brady, 1879, etc., RRC. 1879, p. 56, pl. v, figs. 10 *a*, *b*, 11; 1884, FC. p. 342, pl. xl, figs. 13–16.
Haplophragmium ,, Cushman, 1910, etc., FNP, 1910, p. 100, fig. 148.

Stations 6, 11, 13, 25, 27, 29, 32, 41, 44 (+ D).

Never more than a single specimen. A considerable range in colour, from deep ochraceous to almost white. A very large (broken) specimen at Station 25.

168. *Trochammina ringens*, Brady.

Trochammina ringens, Brady, 1879, etc., RRC, 1879, p. 57, pl. v. figs. 12 *a*, *b*; 1884, FC. p. 343, pl. xl, figs. 17, 18.
,, ,, Millett, 1898, etc., FM. 1899, p. 365, pl. v, fig. 14.

Station 6.

Two very fine examples.

169. *Trochammina pauciloculata*, Brady.

Trochammina pauciloculata, Brady, 1879, etc., RRC. 1879, p. 58, pl. v, figs. 13, 14; 1884, FC. p. 344, pl. xli, figs. 1, 2.
Ammochilostoma ,, Cushman, 1910, etc., FNP. 1910, p. 126, figs. 197.

Stations 7, 8, 10, 11, 29, 32, 35, 40, 55.

Most frequent and best at Station 10. At Station 29 specimens were of a curiously elongate narrow-chambered form, evidently pauperate.

170. *Trochammina galeata*, Brady.

Trochammina galeata, Brady, 1879, etc., RRC. 1881, p. 52; 1884, FC. p. 344, pl. xl, figs. 19–23.
,, ,, Cushman, 1910, etc., FNP. 1910, p. 127, figs. 198–201.

Stations 29, 40.

One unquestionable, and two not so satisfactory, examples at these Stations.

171. *Trochammina robertsoni*, Brady.

Trochammina robertsoni, Brady, 1876, CPF. p. 80, pl. iii, figs. 6, 7.
,, ,, Wright, 1891, SWI. p. 469, pl. xx, figs. 4, *a*, *b*.
,, ,, Goës, 1894, ASF. p. 30, pl. vi, figs. 231–234.

Stations 13, 29, 34, 35.

The specimens, though few in number, present considerable variation. At Station 29 they are very large and the shell has not the smooth finish due to excessive cement which usually marks the species. At Station 34 a single very thin-walled and pauperate individual; at Station 35 it was quite typical.

172. *Trochammina rotaliformis*, Wright.

Trochammina inflata (Montagu), var., Balkwill and Wright, 1885, DIS. p. 331, pl. xiii, figs. 11, 12.
,, *rotaliformis*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 620.

Stations 2, 4, 6–8, 10, 11, 13, 15, 16, 25, 27, 29, 31, 33, 35, 38, 40, 42–44, 46–50, 52–55 (+ T. d. F., D.).

Almost universally distributed and extremely common in the Antarctic area, especially at Stations 38 and 54. Besides the usual range of specimens running back towards *T. squamata*, a few specimens are to be met with at most Stations where it is abundant, ranging towards *T. vesicularis*, Goës (G. 1894, ASF. p. 31, pl. vi, figs. 235–237), which has more whorls, and more segments to the whorl, and generally speaking a more pronounced rotalian contour than Wright's

original species, but is hardly worth separation. At Station 6 a sessile individual, embedded in white cement, was observed.

[Hyaline isomorph, *Discorbina globularis* (d'Orb.).]

WEBBINA, d'Orbigny.

173. *Webbina clavata* (Jones and Parker).

Trochammina irregularis clavata, Jones and Parker, 1860, RFM. p. 304.
Webbina (*Ammolagena*) *clavata*, Cushman, 1910, etc., FNP. 1910, p. 68, figs. 86–89.

Stations 6, 16, 23, 25, 29, 36, 39 (+ T. d. F.).

Sparingly represented at all the Stations and presenting no special features excepting at Station 6 (N.Z.). Here the type occurs, but less abundantly than the moniliform variety originally described by d'Orbigny from a figure of Cornuel's as *Webbina irregularis* (q.v. *post*). The difference in the shape of the chambers makes it worth while recording this as a separate form, though there can be little doubt as to the zoological identity of the specimens.

174. *Webbina irregularis*, d'Orbigny. Pl. III, fig. 24.

Oeufs d'autres Mollusques, Cornuel, 1848, NFM, p. 259, pl. iv, fig. 37.
Webbina irregularis, d'Orbigny, 1850, etc., PP. vol. ii, p. 111, No. 783.
,, *laevigata*, Costa, 1853, etc., PRN. 1856, 187, pl. xvi, fig. 14

Station 6.

Attached to stones and differing from *W. clavata* in the smaller size of the chambers, their pyriform shape, and the arrangement in a continuous chain of three or more segments, often variable in shape, adapting themselves to the contour of the host. Constructed like *W. clavata*, of fine sand with a maximum of reddish cement, colour varying as in that species, from pale yellowish-grey to deep brown.

It is extremely interesting to find this form, hitherto exclusively known as a fossil, from the Lias upwards, in the recent condition. The N.Z. specimens differ from Cornuel's original figure, and subsequent figures, in the length of the stolon-tubes between the successive chambers. In some instances the stolon is as long as the chamber itself. The nearest approach perhaps, is the specimen figured by Costa, *ut supra*.

Sub-Family LOFTUSINAE.

CYCLAMMINA, Brady.

175. *Cyclammina pusilla*, Brady.

Cyclammina pusilla, Brady, 1879, etc., RRC. 1881, p. 53; 1884, FC. p. 353, pl. xxxvii, figs. 20–23.
,, ,, Cushman, 1910, etc., FNP. 1910, p. 111, fig. 172.

Stations 13, 19, 20, 21, 22, 23, 24, 25, 28, 32, 33–36, 39, 40, 42.

This is perhaps the most typical Foraminifer of all the deep-water Stations

between the N.Z. area and the Antarctic coast-line, extending between Stations 13 and 42, which latter is the most southerly record. The finest series at Station 40. Other good examples at Stations 32, 33, 34. At Station 39 all the individuals were notably small.

176. *Cyclammina cancellata*, Brady.

Cyclammina cancellata, Brady, 1879, etc., RRC. 1879, p. 62 (*Nautiloid lituola*); 1884, FC. p. 351, pl. xxxvii, figs. 8–16.
„ „ Cushman, 1910, etc., FNP. 1910, p. 110, figs. 168–171.

Stations 18, 23, 29 (+ D.).

A single imperfect but undoubted specimen at Station 18, small ones at Stations 23 and 29.

177. *Cyclammina orbicularis*, Brady.

Cyclammina orbicularis, Brady, 1879, etc., RRC. 1881, p. 53; 1884, FC. p. 353, pl. xxxvii, figs. 17–19.
„ „ Cushman, 1910, etc., FNP. 1910, p. 113, fig. 173.

Stations 8, 16, 23, 29, 32, 35.

One large and typical specimen from Station 8. Similar specimens from Stations 23, 29, and 32. A doubtful specimen from Station 35.

Family TEXTULARIIDAE.

Sub-Family TEXTULARIINAE.

TEXTULARIA, Defrance.

178. *Textularia inconspicua*, Brady.

Textularia inconspicua, Brady, 1884, FC. p. 357, pl. xlii, fig. 6.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 623, pl. xlvii, figs. 1–4.

Stations 2, 3, 5, 6 (+ R. d. J.).

Very fine and typical specimens attaining considerable size at Stations 5 and 6. All the examples are much nearer to Brady's figure than to Millett's, and they are all characterized by thick bands of clear shell-substance, marking the sutural lines and originating in a thick striated ring, which forms the basal outline of the successive chambers, as shown in Brady's fig. 6 *b*. This thick band gives an appearance of limbation, but when seen in side view none of the specimens are truly limbate, and thus referable to the var. *jugosa*.

Cushman (C. 1919, RFNZ. p. 626) refers this form to the Rotaliidae, under the name of *Discorbis inconspicua*, Brady, referring to Millett and Brady and his own previous remarks (C. 1910, etc., FNP. 1911, p. 11). He states that from six N.Z. specimens he has been able to determine definitely that the form should be placed among the Rotaliidae, "in some of its markings it resembles *Patellina*

. . . it seems to be a species in which the chambers each make a half-coil as added, and its resemblance to *Textularia* is only superficial." We are quite unable to agree with this. An examination of a very great number of specimens from many localities show that beyond an apical "multiformity" limited to the first three or four chambers, the shell is a true Textularian. The genus *Textularia* is particularly subject to multiformity in its early stages. In *T. inconspicua* the early growth appears to be the normal spiroplectine coil observable in most species, but set at a different angle to the subsequent axis of growth. Millett's specimens, which are now in our collection, and which are very numerous, give no support to Cushman's theory, and the "minute rotalian," to which Millett refers as occurring in association with *T. inconspicua*, does not appear on his slides, nor is it otherwise referred to in his papers among the Discorbinae. It appears probable, therefore, that in the intervening years between 1899 and 1903 he obtained no further evidence inducing him to alter his views in assigning the form to *Textularia*.

179. *Textularia concava* (Karrer).

Plecanium concavum, Karrer, 1868, MFKB. p. 129, pl. i, fig. 3.
Textularia concava, Heron-Allen and Earland, 1914, etc., FKA, 1915, p. 624.

Stations 2–6, 9.

Confined to the N.Z. area, the best at Stations 3 and 6, where it attains a large size and is very typical and neatly constructed. At the same Stations occasional specimens are strongly limbate. This variation appears to be the *T. crassisepta* of Cushman (C. 1910, etc., FNP. 1911, p. 24, fig. 41). At Station 6, intermediate forms linking Karrer's very well-marked type with the wildly growing var. *heterostoma* occur. At Station 9 the record stands on a single small individual with a hyaline shell.

180. *Textularia concava*, var. *heterostoma*, Fornasini.

Sagraina affinis, Fornasini, 1883, FPS. p. 189, pl. ii, fig. 10.
Textularia concava, var. *heterostoma*, Heron-Allen and Earland, 1916, FWS. p. 229, pl. xl, figs. 22, 23.

Stations 3, 4, 6, 8–11, 16, 18, 19, 22, 36 (+ T. d. F., D.).

The specimens from Stations 3, 4 and 6, especially the latter, are large and typical, exactly representing Fornasini's figures. They are linked up with the type by a few intermediate specimens. The individuals from the remaining Stations present a very different appearance, and, generally speaking, can only be relegated to Fornasini's variety by association with a long series of specimens. They are small, rough in surface-texture, and the aperture is often produced upon a phialine neck instead of being a prominent crescentiform slit. The figure of *Sagraina affinis*, Fornasini (*ut supra*) very well represents the prevalent type; this is the *T. catenata* of Cushman (C. 1910, etc. F.N.P. 1911, p. 23, figs. 39–40).

At Station 6 two extremely abnormal individuals, one, fossil, which we have described and figured elsewhere (H.-A. & E. 1920, VP. p. 161, pl. xvi, fig. 3). This is the *Globotextularia anceps* (Brady) of Eimer and Fickert (1899, Artbildung und Verwandtschaft, pp. 559 and 563, figs. 6 and 10; and Cushman, 1910, etc. FNP. 1910, p. 125, fig. 25). The other, to all appearance recent. The latter specimen is broken, but when perfect the oral extremity appears to have terminated in a series of large globular chambers irregularly disposed round the textularian aperture on the last normal chamber.

[Arenaceous isomorph of the abnormal form, *Haplophragmium anceps*, Brady.]

181. *Textularia sagittula*, Defrance.

Textularia sagittula, Defrance, 1824, Dict. Sci. Nat., vol. xxxii, p. 177; vol. liii. p. 344; Atlas Conch. pl. xiii, fig. 5.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 625.

and

Spiroplecta wrightii, Silvestri.

Spiroplecta sagittula (Defrance), Wright, 1891, SWI. p. 471.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 634.

Stations 2, 3, 5, 6.

These two forms occur, as usual, in company, and we have less hesitation than ever as to their specific identity. Both are characterized whenever they occur by fistulose development. The best range occurs at Station 6, where *T. sagittula* attains a very fine development in pectinate forms such as *T. mariae*, d'Orb. (d'O., 1846, FFV. p. 246, pl. xiv, figs. 29–31), and *T. pectinata*, Reuss (R., 1849–50, FOT. p. 381, pl. xlix, figs. 2, 3). In a few instances the pectination is even more strongly developed than in either of these forms, developing into pronounced fistulose tubules. These individuals are, perhaps, racially distinct from *T. sagittula*, as no spiroplectine individuals having the glistening, smoothly agglutinated, external shell-layer, which characterizes the pectinate individuals were observed. The typical *T. sagittula* and the typical *S. wrightii* have a characteristically matt surface.

181A. *Textularia milletti*, Cushman.

Textularia milletti, Cushman, 1910, etc., FNP. 1911, p. 13, figs. 18, 19.

Station 11.

Very rare but typical. They resemble Cushman's figures much more closely than the figure of Millett of *T. sagittula*, var. *jugosa*, T. R. Jones (M., 1898, etc., FM, 1899, p. 561, pl. vii, fig. 8), on which Cushman's new specific name is founded.

182. *Textularia rugosa* (Reuss).

Plecanium rugosum, Reuss, 1869, FOG. p. 453, pl. i, fig. 3.
Textularia rugosa, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 625, pl. xlvii, figs. 7–9.

Stations 2, 6.

Frequent at Station 2, where it attains considerable development, including fistulosity in a minor degree. Many specimens have obviously grown attached to Zoophytes.

183. *Textularia agglutinans*, d'Orbigny.

Textularia agglutinans, d'Orbigny, 1839, FC. p. 144, pl. i, figs. 17, 18, 32–34.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 626.

Stations 1–4, 6, 8.

Abundant and variable. At most of the Stations there is a marked tendency to limbation, running the specimens into *T. rugosa*. At Station 6, in addition to the type and rugose forms, there is a smooth-walled variety running imperceptibly into the swollen chambered *T. candeiana*. At Station 2, an abnormal specimen in which the last four chambers were set with the axis at right angles to the earlier growth. At Station 6 individuals living attached to Polyzoa, similar to the *T. sagittula* recorded by us from the West of Scotland (H.-A. & E., 1916, FWS. p. 229.)

184. *Textularia candeiana*, d'Orbigny.

Textularia candeiana, d'Orbigny, 1839, FC. p. 143, pl. i, figs. 25–27.
,, ,, Heron-Allen and Earland,1914, etc., FKA. 1915, p. 627, pl. xlvii, figs. 10–16.

Stations 6, 11.

A few remarkably fine and typical specimens from Station 6 characterized by the thinness and even texture of the finely agglutinated walls. One small specimen from Station 11.

185. *Textularia porrecta*, Brady. Pl. IV, figs. 6, 7.

Textularia agglutinans, var. *porrecta*, Brady, 1884, FC. p. 364, pl. xliii, fig. 4.
,, *porrecta*, Egger, 1893, FG. p. 269, pl. vi, figs. 17, 18.
,, *sagittula*, var. *fistulosa*, Brady, 1884, FC. p. 362, pl. xlii, fig. 19 (only).
Spiroplecta sagittula, and var. *fistulosa*, Chapman, 1905, GBI. p. 87, pl. iii, fig. 4.
,, *siphonifera*, Chapman, 1909–10, SBL. p. 272, pl. iii, fig. 1.
Textularia stricta, Cushman, 1910, etc., FNP. 1911, p. 11, fig. 13.
Textularioides inflata, Cushman, *ibid.*, p. 26, fig. 45.

Stations 2, 6.

Frequent only at Stations 2 and 6, but well known to us from many dredgings in adjacent areas. It is a large and striking Textularian characterized by several features rarely seen in other forms. So far as we have been able to trace, all the specimens are spiroplectine in the early stages, but this is rapidly followed by a long series of chambers, wedge-shaped at first, in the manner of *T. sagittula*, but rapidly becoming inflated, so that the terminal portion of the shell is almost circular in cross-section. The number of chambers in the finest specimens reaches as many as twenty pairs.

The test is coarsely constructed of sand-grains, the whole plastered over with

a fine superficial layer of cement composed of the finest mud, and apparently highly perforate. This thin superficial layer is, in nearly all instances, produced out at the edge into fistulose extensions. In the most typical examples this fistulosity extends the entire length of the shell; in others it is confined to the initial half. In a few instances it extends backwards from the fistulose tubes as a ridge along the middle of each chamber towards the median line, and when broken away leaves a very characteristic scar across the chamber, hardly distinguishable from the limbation of *T. rugosa*, though due to quite another cause.

These N.Z. specimens appear to link up two widely differentiated species, *T. sagittula* and *T. agglutinans*. In their compressed cuneiform outline, spiroplectine initial chambers, and fistulosity, they closely indicate a relationship to *T. sagittula*, Defr., whereas the inflated later chambers and the oval, or nearly circular, cross-section of the later plan are characteristic of *T. agglutinans*. Brady's Fig. 19, *T. sagittula*, var. *fistulosa*, differs from the other three figures in the swollen character of the later chambers and probably represents the N.Z. form. Chapman, in his Batesford Limestone paper, assigns Brady's form to *Spiroplecta*, and, in his Barrier Island paper, describes both the plain and the fistulose types under *S. sagittula*. We have already published our views on this question of the separation of the spiroplectine forms (H.-A. & E., 1913, CI, p. 57). Cushman's *T. stricta* appears without question to be the same as our form. No mention is made by him of the nature of the initial chambers, but the rounded extremity of his figure strongly suggests a spiroplectine beginning. Under the name *Textularioides inflata* (gen. nov., sp. nov.) he figures a single attached specimen which appears to be inseparable from this form. Incidentally it may be noted that at both the "Terra Nova" Stations specimens occur which have been attached to Polyzoa, and sessile individuals are recorded in many species of *Textularia*.

186. *Textularia fungiformis*, Fornasini.

Textularia fungiformis, Fornasini, 1887, ITI. p. 396, pl. x, figs. 1, 1 *a*, *b*; 1896, TC. p. 2, *et seq.* pl. 0, figs. 1–5.

Stations 1, 3.

The tendency to variation by expansion of the later-formed chambers in *T. agglutinans* reaches its extreme development at Stations 1 and 3, resulting in typical specimens of this species.

187. *Textularia abbreviata*, d'Orbigny.

Textularia abbreviata, d'Orbigny, 1846, FFV. p. 249, pl. xv, figs. 7 (not 9)–12.
„ „ Cushman, 1910, etc., FNP, 1911, p. 14, fig. 20.

Station 6.

A few good specimens at this single Station.

188. *Textularia gramen*, d'Orbigny.

Textularia gramen, d'Orbigny, 1846, FFV. p. 248, pl. xv, figs. 4–6.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 627.

Stations 2–7 (+ R. d. J.).

Frequent and very variable, running through abnormal specimens into *T. conica*, *agglutinans*, and *abbreviata*. At several Stations specimens showing marked limbation, and in a few instances rudimentary fistulosity. Most variable at Station 6.

189. *Textularia conica*, d'Orbigny.

Textularia conica, d'Orbigny, 1839, FC. p. 143, pl. i, figs. 19, 20.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 629.

Stations 1–3, 6 (+ R. d. J.).

Typical specimens, fairly abundant at Station 6.

190. *Textularia conica*, var. *horrida*, Egger. Pl. IV, figs. 3, 4.

Textularia horrida, Egger, 1893, FG. p. 270, pl. vi, figs. 11, 12.
,, ,, Cushman, 1910, etc., FNP. 1911, p. 10, fig. 12.

Stations 1–3, 6.

Strongly fistulose specimens occur in company with the type, *T. conica*, at the N.Z. Stations. Their nearest congener is *T. horrida*, Egger, but the N.Z. specimens are much more neatly and regularly fistulose than is indicated by either Egger's or Cushman's figures. Many of the specimens show limbation somewhat similar to our variety *corrugata* (H.-A. & E., 1914, etc., FKA., 1915, p. 629, pl. xlvii, figs. 24–27), which is very probably a passage-form between the smooth edged type *T. conica* and its fistulose form, var. *horrida*. Size varies between ·30–·50 mm. in length and ·40–·55 mm. in breadth.

191. *Textularia trochus*, d'Orbigny.

Textularia trochus, d'Orbigny, 1840, CBP. p. 45, pl. iv, figs. 25, 26.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 630, pl. xlvii, fig. 28.

Stations 1–3, 6.

Rare except at Station 6, very fine specimens there, and at Station 2. One sessile specimen at Station 6.

SPIROPLECTA, Ehrenberg.

192. *Spiroplecta annectens* (Parker and Jones).

Textularia annectens, Parker and Jones, etc., 1859, etc., NF. No. 8, 1863, p. 92, fig. 1.
Spiroplecta ,, Millett, 1898, etc., FM. 1900, p. 8, pl. i, fig. 7.

Stations 6, 29, 33.

One megalospheric individual from Station 6, closely resembling Millett's figure, and two small microspheric at the Antarctic Stations, very long and narrow.

193. *Spiroplecta biformis* (Parker and Jones).

Textularia agglutinans, var. *biformis*, Parker and Jones, 1865, NAAF. p. 370, pl. xv, figs. 23, 24.
Spiroplecta biformis, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 634.

Stations 9, 17, 40 (+ T. d. F.).

One specimen at Station 9, a few of the long type at Station 17, and common at Station 40, where all the specimens were of a small and rather coarsely constructed variety.

GAUDRYINA, d'Orbigny.

194. *Gaudryina pupoides*, d'Orbigny.

Gaudryina pupoides, d'Orbigny, 1840, CBP. p. 44, pl. iv, figs. 22–24.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 634.

Stations 6, 7, 10, 12.

Few in number, the best at Station 7.

195. *Gaudryina subrotundata*, Schwager.

Gaudryina subrotundata, Schwager, 1866, FKN. p. 198, pl. iv, figs. 9 *a–c*.
,, ,, Brady, 1884, FC. p. 380, pl. xlvi, figs. 13 *a–c*.
,, ,, Flint, 1899, RFA. p. 287, pl. xxxiii, fig. 1.

Stations 6, 10, 16.

Very rare and poorly developed, except at Station 6, where a few very large individuals were found.

196. *Gaudryina filiformis*, Berthelin.

Gaudryina filiformis, Berthelin, 1880, EAM. p. 25, pl. xxiv, fig. 8.
,, ,, Heron-Allen and Earland, 1913, CI. p. 57, pl. iv, figs. 7–9 ; 1914, etc., FKA. 1915, p. 634.

Stations 10, 11, 13, 27–29, 31, 32, 38, 40, 48, 52, 55 (+ D.).

Almost confined to the Antarctic area. All the specimens are of the minute, many-chambered type commonly found round the Scotch and Irish Coasts. The best at Stations 27, 28, and 29. At the more southerly Stations the individuals do not attain such fine development. We see no reason for modifying Brady's acceptance of Berthelin's species for the recent forms.

197. *Gaudryina rugosa*, d'Orbigny. Pl. IV, figs. 16, 17.

Gaudryina rugosa, d'Orbigny, 1840, CBP. p. 44, pl. iv, figs. 20, 21.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 635.

Stations 1–6.

Confined to the N.Z. area, where it attains fine development, notably at Station 2. At all the Stations it occurs in two distinct forms, the type repre-

sented by (*a*) short, comparatively few-chambered, stoutly-built individuals, and (*b*) a very long, narrow, sharply angular type, ranging up to 1·10 mm. in length, characterized by an abnormally large number of gaudryine (triserial) chambers. The two may possibly represent the megalo- and micro-spheric conditions. The short form is found living sessile upon Polyzoa at Station 6.

198. *Gaudryina scabra*, Brady.

Gaudryina pupoides, Brady, 1870, FTR. p. 300, pl. xii, fig. 5.
„ *scabra*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 635, pl. xlviii, figs. 7–14.

Station 23.

One typical specimen.

199. *Gaudryina siphonella*, Reuss.

Gaudryina siphonella, Reuss, 1851, FSUB. p. 78, pl. v, figs. 40-42.
„ „ Brady, 1884, FC. p. 382, pl. xlvi, figs. 17–19.
„ „ Sidebottom, 1918, FECA. p. 23, pl. ii, figs. 24, 25.

Stations 7, 13, 18.

A few typical specimens at Station 7, a sounding for which no depth is given, and one typical example from Station 13 (3,003 fms.).

200. *Gaudryina ferruginea*, sp. nov. Pl. IV, figs. 13–15.

Station 6.

Test free, multiform, the earlier portion consisting of closely-adherent triserial chambers about seven in number, followed by two or three pairs of compressed biserial chambers, with angular edges, the compressed portion sometimes having a lateral twist. Constructed of large, flat sand-grains and ferruginous cement, very dark brown at the initial portion of the shell, becoming brighter in colour at the oral extremity. Septation very obscure, especially in the earlier chambers. Aperture, a normal loop on the inner face of the terminal chamber.

Dimensions :—Length, ·30–·40 mm. ; breadth, ·20 mm.

This distinctive little form is confined to Station 6, where a fair number of specimens were observed. It cannot easily be mistaken for any other species, but apparently belongs to the same group as *G. wrightiana*, Millett (M. 1898, etc., FM. 1900, p. 10, pl. i, figs 11, 12) *G. jonesiana*, Wright (W. 1885–6, KH. p. 329, pl. xxvii, figs 1, 2) and *G. pariana*, Guppy (G. 1894, FMDT. p. 651, pl. xli, figs. 21, 22). Characterized by the small initial triserial development, and the compressed biserial subsequent chambers. It bears some superficial resemblance in the colour and rough construction of the shell to *Verneuilina polystropha* (Reuss), but is readily distinguished by the compressed biserial chambers. The colour is very distinctive.

VERNEUILINA, d'Orbigny.

201. *Verneuilina spinulosa*, Reuss.

Verneuilina spinulosa, Reuss, 1849–50, FOT. p. 374, pl. ii (xlvii), fig. 12.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 630

Station 2.

A single spineless individual.

202. *Verneuilina triquetra* (Münster).

Textularia triquetra, Roemer, 1838, CNTM. p. 384, pl. iii, fig. 19.
Verneuilina „ Brady, 1884, FC. p. 383, pl. xlvii, figs. 18–20.
„ „ Millett, 1898, etc., FM. 1900, p. 10.

Stations 1–6.

Common at some Stations in the N.Z. area, the specimens as a rule small, excepting at Station 6.

203. *Verneuilina turris*, sp. nov. Pl. IV, figs 8–12.

Stations 3, 4, 5, 6 (+ R. d. J.).

Test free, consisting of a triserial arrangement of chambers forming a cylinder with a bluntly conical apex, and an abruptly truncate base, containing the aperture, which is a verneuiline loop on the inner edge of the final chamber. Surface coarsely punctate. Sutural lines, thick, sometimes limbate, not perforate on the sutural lines. Usually pale brown in colour at the apex and becoming colourless in the later chambers.

Size :—Length, ·15–·25 mm. ; breadth, ·12–·15 mm.

Common at Station 6, and less frequent at Stations 3 and 5.

We have long been familiar with this little form, which occurs in many shallow-water gatherings from N.Z. The plan of the arrangement of the early chambers is very difficult to determine, but it appears to be spiral, as in the initial chambers of *Textularia inconspicua* (*q.v.*), but the triserial arrangement is immediately assumed, and retained during the remainder of the life of the animal and the whole aspect of the shell is distinctively verneuiline.

204. *Verneuilina polystropha* (Reuss).

Bulimina polystropha, Reuss, 1845–6, VBK. pl. ii, p. 109, pl. xxiv, fig. 53.
Verneuilina „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 631 ; 1920, VP. (*passim*), pl. xvi–xviii.

Stations 7, 29 (+ D.).

Extremely rare.

205. *Verneuilina pusilla*, Goës.

Verneuilina pygmaea, Goës, 1894 ASF. p. 33, pl. vii, figs. 262–3.
„ *pusilla*, Goës, 1896, DOA. p. 39, pl. v, figs. 6–8.
„ *polystropha*, Heron-Allen and Earland, 1913, CI. p. 55, pl. iv, figs. 3–5.
„ *pusilla*, Heron-Allen and Earland, 1920, VP. (*passim*) pl. xvi, fig. 11, pl. xvii, figs. 12, 13.

Stations 27, 29, 52, 55.

Confined to the Antarctic. Rare, but very typical, the best at "Farthest South" (Station 55), both megalo- and micro-spheric.

206. *Verneuilina pygmaea* (Egger).

Bulimina pygmaea, Egger, 1857, MSO. p. 284, pl. viii (xii), figs. 10, 11.
Verneuilina „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 631.

Stations 7, 11, 12, 16, 18–20, 22, 25, 28, 32–36, 40, 55 (+ D.).

Occurs in both areas and in some numbers as far as Station 20, after which the records are of single specimens at the Stations down to Station 36, where it reappears plentifully. It then disappears until Station 55, where a single large specimen was found. There are two types, megalospheric, which is very short and few-chambered, and the microspheric, a larger, longer shell with many chambers. The two, as a rule, occur together where the species is abundant, but at Station 36, where it was plentiful, only the megalospheric type occurs.

207. *Verneuilina propinqua*, Brady.

Verneuilina propinqua, Brady, 1884, FC. p. 387, pl. xlvii, figs. 8–14.
„ „ Burrows, Sherborn and Bailey, 1890, RC. p. 553, pl. viii, fig. 18 *a*, *b*.
„ „ Grzybowski, 1901, OWI. p. 224, pl. ix, fig. 18.

Stations 16, 22, 40 (+ D.).

Except at Station 16, where several specimens, and many more fragments of what must have been very large specimens, were found, the species is very rare. It should, in our opinion, be recorded merely as an arenaceous variety of *V. pygmaea*.

VALVULINA, d'Orbigny.

208. *Valvulina fusca* (Williamson).

Rotalina fusca, Williamson, 1858, RFGB. p. 55, pl. v, figs. 114, 115.
Valvulina „ Cushman, 1910, etc., FNP. 1911, p. 59, figs. 94, 95.

Station 6.

Both free and sessile individuals.

209. *Valvulina conica*, Parker and Jones.

Valvulina triangularis, Parker and Jones, 1857, FCN. p. 295, pl. xi, figs. 15, 16.
„ *conica*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 635.

Station 6.

A few examples both sessile and free.

CLAVULINA, d'Orbigny.

210. *Clavulina communis*, d'Orbigny.

Clavulina communis, d'Orbigny, 1826, TMC. p. 268, no. 4.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 636, pl. xlviii, figs. 15–17.

Stations 2, 3, 6, 7, 8, 10–12, 16–18, 22, 28, 33–35, 42.

A series of specimens of this species offer an interesting illustration of the influence of environment on external form. No tyro, confronted with specimens from Station 3 and any of the deep-water Stations to the south, would imagine that the same organism was responsible for both. In the shallow water of the N.Z. area as far as Station 6, where the sand is comparatively coarse, the animal constructs a stout, short cylindrical test, broad in proportion to its length. As the water deepens and the size of the mineral grains becomes smaller, the test becomes longer, narrower, smoother in construction, until in the deepest water Stations, where it occurs, the test is practically cylindrical without external sign of the clavuline initial chambers; perfectly smooth owing to the fineness of the constituent material, and only recognizable externally by the projecting tubular aperture. Some of these deep-water specimens attain a great size, unbroken specimens 4–5 mm. long were found at Stations 10 and 11, and at Station 16 fragments indicating specimens which must have been three times that size.

211. *Clavulina obscura*, Chaster.

Verneuilina polystropha (Reuss), "dimorphous form," Wright, 1885–6, BLP. p. 320, pl. xxvi, fig. 2.
Clavulina obscura, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 636.

Stations 6, 55.

A single specimen at each Station referable to this obscure species.

212. *Clavulina parisiensis*, d'Orbigny.

Clavulina parisiensis, d'Orbigny, 1826, TMC. p. 268, no. 3, Modèle no. 66.
,, ,, Cushman, 1910, etc., FNP. 1911, p. 75, figs. 123, 124.

Station 53 (+ R. d. J.).

One very small but typical specimen. Its occurrence in such a southern latitude is noteworthy.

213. *Clavulina cylindrica*, Hantken.

Clavulina cylindrica, Hantken, 1875, CSS. p. 18, pl. i, fig. 8.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 636, pl. xlviii, figs. 18, 19.

Stations 3, 6, 10, 11 (+ R. d. J.).

Confined to the N.Z. area and reaching its maximum development at Station 6, where it occurs in every conceivable variety, from almost spherical to cylin-

drical with almost parallel sides. The method of construction varies equally widely, some of the specimens are smoothly, but loosely, constructed, sponge-spicules being largely employed, and have a rough-cast appearance. In others, although the constituent materials are very much larger, other Foraminifera affording favourite material, the interstices are so carefully plastered up with finer material and mud as to give an unbroken outline to the test. The aperture is usually at the end of a short produced neck with the clavuline tooth, but in many specimens is flush with the wall and difficult to distinguish.

Sub-Family BULIMININAE.

BULIMINA, d'Orbigny.

214. *Bulimina pupoides*, d'Orbigny.

Bulimina pupoides, d'Orbigny, 1846, FFV. p. 185, pl. xi, figs. 11, 12.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 637.

Stations 3, 6, 16, 24.

Fairly good specimens, but uncommon.

215. *Bulimina elegans*, d'Orbigny.

Bulimina elegans, d'Orbigny, 1826, TMC. p. 270, no. 10, Modèle no. 9.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 638.

Stations 3, 6, 29.

Neither common nor very typical. The best at Station 29.

216. *Bulimina elegans*, var. *exilis*, Brady.

Bulimina elegans, var. *exilis*, Brady, 1884, FC. p. 399, pl. L, figs. 5, 6.
„ „ „ „ Heron-Allen and Earland, 1916, FWS. p. 234, pl. xli, figs. 4–9.

Station 7.

Fairly typical, but hardly as long as the type demands.

217. *Bulimina fusiformis*, Williamson.

Bulimina pupoides, var. *fusiformis*, Williamson, 1858, RFGB. p. 63, pl. v, figs. 129, 130.
„ *fusiformis*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 638.

Stations 3, 7–9, 16, 27, 36.

Excellent specimens at Stations 7, 8, 16 and at Station 27, but curiously rare considering the abundance with which this species generally occurs where it is found at all.

218. *Bulimina pyrula*, d'Orbigny.

Bulimina pyrula, d'Orbigny, 1846, FFV. p. 184, pl. xi, figs. 9, 10.
„ „ Brady, 1884, FC. p. 399, pl. L, figs. 7–10.

Station 6.

Two typical specimens.

219. *Bulimina ovata*, d'Orbigny.

Bulimina ovata, d'Orbigny, 1846, FFV. p. 185, pl. xi, figs. 13, 14.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 638.

Station 6, 7, 28.

One record only in the Antarctic. Very fine specimens at Stations 6 and 17. At Station 6 many have apical spines, a not uncommon variation in this species, as in *B. pyrula*.

220. *Bulimina affinis*, d'Orbigny.

Bulimina affinis, d'Orbigny, 1839, FC. p. 105, pl. ii, figs. 25, 26.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 638.

Stations 6, 7 (+ T. d. F.).

A fine typical example at Station 6, poor at Station 7.

221. *Bulimina marginata*, d'Orbigny.

Bulimina marginata, d'Orbigny, 1826, TMC. p. 269, no. 4, pl. xii, figs. 10–12.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 640.

Stations 2–4, 6, 8, 13, 14, 41, 49 (+ R. d. J.).

Never very abundant, excepting at Station 6, where a fine series, running into *B. aculeata*, was found.

222. *Bulimina aculeata*, d'Orbigny.

Bulimina aculeata, d'Orbigny, 1826, TMC. p. 269, no. 7.
,, ,, Cushman, 1910, etc., FNP. 1911, p. 86, fig. 139.

Stations 3, 6–12, 14, 27, 29, 31, 32, 41 (+ R. d. J.).

Best in the N.Z. area, especially Stations 9, 10, and 11. At Station 10 a double specimen with two apertures. The spines are most pronounced in the deep-water Stations, reaching a maximum at Station 27 where, however, the species was uncommon.

223. *Bulimina echinata*, d'Orbigny.

Bulimina echinata, d'Orbigny, 1826, TMC. p. 269, no. 5.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. p. 640; 1916, FWS. p. 235, pl. xli, fig. 3.

Stations 10–12, 31.

This species differs from *B. aculeata* by being finely hispid all over the surface of the chambers instead of having the spines confined to their margins. It is very rare, but well marked specimens occur, the best at Station 11.

224. *Bulimina inflata*, Seguenza.

Bulimina inflata, Seguenza, 1862, RFC. p. 109 (p. 25 in the reprint), pl. i, fig. 10.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 641.

Stations 6, 7.

Extremely rare, but very typical.

225. *Bulimina buchiana*, d'Orbigny.

Bulimina buchiana, d'Orbigny, 1846, FFV. p. 186, pl. xi, figs. 15–18.
„ „ Cushman, 1910, etc., FNP. 1911, p. 85, fig. 138.

Stations 6, 7, 9.

Very good and fairly numerous at Station 7. Typical at Station 6, typical but very small at Station 9.

226. *Bulimina rostrata*, Brady.

Bulimina rostrata, Brady, 1884, FC. p. 408, pl. li, figs. 14, 15.
„ „ Cushman, 1910, etc., FNP. 1911, p. 87, fig. 140.

Station 7.

A good many typical specimens.

227. *Bulimina elegantissima*, d'Orbigny.

Bulimina elegantissima, d'Orbigny, 1839, FAM. p. 51, pl. vii, figs. 13, 14.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 639.

Stations 2, 3, 6, 8, 38.

Rare, the best at Station 6. One large specimen at Station 38.

228. *Bulimina elegantissima*, var. *seminuda*, Terquem.

Bulimina seminuda, Terquem, 1882, FEP. p. 117, pl. xii (xx), fig. 21.
„ *elegantissima*, var. *seminuda*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 639.

Stations 1, 2, 5, 6, 27.

Abundant and very variable. A single specimen only, in the Antarctic. Two distinct types, megalospheric and microspheric, occur together at all the N.Z. Stations, and the shape of the shell is mainly influenced by this character of the primordial chamber, the microspheric specimens being acutely pointed and increasing in width gradually to the oral extremity, whereas the megalospheric are bluntly rounded at the apex and show very little increase in width with the growth of the shell. At Station 6, where a very fine series of all sizes and types occurred, a pair was found in association (not budding, as described by us elsewhere (H.-A. 1915, RPF. p. 248, pl. xv, figs. 28 *a–f*)), but specimens were found here and at other Stations with absorbed terminal walls, suggesting this condition. Many of the microspheric specimens approach Sidebottom's var. *fusiformis* (S. 1918, FECA. p. 123, pl. iii, figs. 8–10), but rarely show the exaggerated tapering towards the oral extremity from the mid-growth of the shell, which characterizes his variety. In the same way, many of these specimens are furnished with a blunt spine at the apex, but only one example bearing a terminal spine and referable to Chapman's var. *apiculata* was found, at Station 6 (C. 1907, TFV. p. 31, pl. iv, fig. 77; and S. 1918, FECA. p. 123, pl. iii, fig. 11).

229. *Bulimina subteres*, Brady.

Bulimina subteres, Brady, 1879, etc., RRC., 1881, p. 55; 1884, FC. p. 403, pl. L, figs. 17, 18.
,, ,, Heron-Allen and Earland, 1913, CI. p. 62, pl. iv, figs. 13, 14.

Stations 3, 6, 27, 31, 55.

Rare but very typical, and all equally good.

230. *Bulimina declivis*, Reuss.

Bulimina declivis, Reuss, 1863–4, KTF. p. 55, pl. vi, figs. 70 *a*, *b*; pl. vii, fig. 71.
,, ,, Brady, 1884, FC. p. 404, pl. L, 19 *a*, *b*.

Station 6.

An excellent and typical series of this rare form at this single Station.

231. *Bulimina williamsoniana*, Brady.

Bulimina williamsoniana, Brady, 1879, etc., RRC. 1881, p. 56; 1884, FC. p. 408, pl. li, figs. 16, 17.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 641.

Stations 5, 6.

A good many typical specimens. Some show an absorbed final chamber which may indicate viviparity, not hitherto recorded in this species.

232. *Bulimina convoluta*, Williamson.

Bulimina pupoides, var. *convoluta*, Williamson, 1858, RFGB. p. 63, pl. v, figs. 132, 133.
,, *convoluta*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 641.

Station 6.

A single specimen, of Williamson's original type, not Millett's Malay type.

233. *Bulimina chapmani*, sp. nov. Pl. IV, figs. 18–20.

Bulimina seminuda, Chapman, 1914, FORS. p. 29, pl. ii, fig. 9 *a*, *b*.

Stations 26, 27, 31, 38, 45–47, 48, 53, 55.

Test free, perforate, helicoid. Consisting of a double series of chambers, arranged in a rapidly increasing spiral, the outer series being largely predominant and increasing in size much more rapidly than the inner series. Sutural lines flush, but often thick, and showing as bands of clear shell-substance. The oral face of the final chamber flat, containing the aperture, which is a well-marked cleft running half-way across the septal face.

Size (across oral face):—Length up to ·80 mm.; breadth up to ·60 mm.; thickness up to ·50 mm.

The specimen figured by Chapman as *B. seminuda* (*ut supra*) bears practically no resemblance to Terquem's species, but is identical with our form. The nearest relation of the species appears to be the *Ataxophragmium humile* of Karrer (K., 1878, FTTL. p. 85, pl. v., fig. 3), but Karrer's figure gives us no

suggestion of the double series of chambers, and the test is arenaceous in texture. *B. contraria* (Reuss) (R., 1851, FSUB. p. 76, pl. v, fig. 37) is closely related, but in this species also, none of the published figures or descriptions give any clue to the biserial arrangement, and in addition, *B. contraria* has a turgid and rounded final chamber instead of the abruptly truncate face of *B. chapmani*. The species is typical of the Antarctic area, occurring at many stations from Nos. 26 to 55, but appears to be confined to the shallower waters, no specimens being observed in the deep-water Stations, the deepest specimen being recorded from 300 fms. (Station 55).

The shell is apparently built in layers, as dead specimens give indications of exfoliation.

234. *Bulimina squammigera*, d'Orbigny.

Bulimina squammigera, d'Orbigny, 1839, FIC. p. 137, pl. i, figs. 22–24.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 642, pl. xlvii, figs. 31–35.

Stations 4, 7.

The specimens are poor.

VIRGULINA, d'Orbigny.

235. *Virgulina schreibersiana*, Czjzek.

Virgulina schreibersiana, Czjzek, 1848, FWB. p. 147, pl. xiii, figs. 18–21.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 642, pl. xlix, figs. 1–12.
,, *sub-depressa*, Fauré-Fremiet, 1914, FMAF. p. 6, pl. 0, fig. 8.

Stations 6–11, 16, 18–20, 22, 23, 27, 29, 31, 36 (+ T. d. F., R. d. J., D.).

Occurs at most Stations frequent and typical, but disappearing at Station 36. The best at Stations 10, 16, 18, 27. At Stations 7 and 36, specimens with apical spines.

236. *Virgulina subsquamosa*, Egger.

Virgulina subsquamosa, Egger, 1857, MSO. p. 295, pl. viii, figs. 19–21.
,, ,, Cushman, 1910, etc., FNP. 1911, p. 92, fig. 145.

Stations 6, 10, 16, 26, 27, 30, 31 (+ R. d. J.).

The best series at Station 6. Good and typical specimens at most of the other Stations where it is recorded.

237. *Virgulina sub-depressa*, Brady.

Virgulina sub-depressa, Brady, 1884, FC. p. 416, pl. lii, figs. 14–17.
,, ,, Cushman, 1910, etc., FNP. 1911, p. 93, fig. 147.

Stations 7, 22.

Very rare at the two Stations.

238. *Virgulina pauciloculata*, Brady.

Virgulina pauciloculata, Brady, 1884, FC. p. 414, pl. lii, figs. 4, 5.
„ „ Liebus, 1902, EOM. p. 81, pl. v, figs. 4 *a*, *b*.

Station 6.

A single typical specimen.

BIFARINA, Parker and Jones.

239. *Bifarina porrecta* (Brady). Pl. IV, figs. 23-26.

Bolivina porrecta, Brady, 1879, etc., RRC. 1881, p. 57; 1884, FC. p. 418, pl. lii, fig. 22.
Bifarina „ Heron-Allen and Earland, 1915, FKA. p. 643.

Station 48.

One very large individual characterized by a great number of chambers, sixteen pairs, and the fact that, in growing, the long axis of the shell traverses almost an entire revolution is noteworthy.

240. *Bifarina porrecta*, var. *arenacea*, nov. Pl. IV, figs. 23–26.

Station 6.

At Station 6 some half dozen examples were obtained of an extremely interesting variety referable to this species, which has hitherto only been known in the hyaline condition. The test is regularly bolivine up to half its length, the chambers then become gradually elongate, the last pair of chambers being produced and terminating in a final oral extremity characteristic of *Bifarina* as opposed to its relative *Bolivina*. The test is composed of fine sand-grains agglutinated with ferruginous cement to form a neat matt surface.

The only form with which these N.Z. specimens could be confused is *Textularia fusiformis*, Chaster (C. 1892, FS. p. 58, pl. i, fig. 3), from which they differ in their rounded edge and oval section. The aperture at the end of a produced extension of the chamber resembles Chaster's form, which occupies a somewhat anomalous position in the genus *Textularia*, and might, perhaps with advantage, be transferred to *Bifarina*. The structure of the test is different, Chaster's species invariably using flakes of mica and other minerals.

Size :—Length ·40–·45 mm.; maximum breadth ·10–·14 mm.; thickness ·08 mm.

BOLIVINA, d'Orbigny.

241. *Bolivina punctata*, d'Orbigny.

Bolivina punctata, d'Orbigny, 1839, FAM. p. 63, pl. viii, figs. 10–12.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 644.

Stations 2–11, 14, 16, 19, 27, 31, 55 (+ R. d. J.).

At most Stations between 2 and 19 fairly common. At most Stations a long, narrow microspheric form was the only representative. At Stations 16 and

19 a shorter, stouter, megalospheric type only occurs. At Stations 6, 8 and 9 both forms are represented, the megalospheric being as a rule very scarce. The best specimens at Stations 4 and 6. At Stations 27 and 31 a very slender hyaline form only occurs.

242. *Bolivina punctata*, var. *arenacea* nov. Pl. IV, figs. 21, 22.

Stations 27, 29, 41, 44, 45, 50, 52, 53, 55 (+ D.).

Between Stations 19 and 27 there are no records of *B. punctata*. At Station 27 the form recurs both in the type and with an arenaceous isomorph which is found at intervals as far south as Station 55. All the specimens are practically identical, constructed somewhat coarsely of fine sand-grains without much cement, so that the surface is rough. They are rather broad at their maximum width, as if it were a passage-form between *B. punctata* and *B. dilatata*, the aperture is very obscure, but in the best specimens is a short compressed tube (bifarine) at the extremity of the final chamber. All the specimens appear to be microspheric.

Size :—Length, ·35 mm. ; maximum breadth. ·13 mm. ; thickness, ·08 mm.

243. *Bolivina textilarioides*, Reuss.

Bolivina textilarioides, Reuss, 1862, NHG. p. 81, pl. x, fig. 1.
,, ,, Brady, 1884, FC. p. 419, pl. lii, fig. 23 (only).

Stations 9, 27 (+ R. d. J.).

A few specimens at Station 9, and one at Station 27, of the smooth type originally figured by Reuss.

244. *Bolivina textilarioides*, var. *spinescens*, Cushman.

Bolivina textilarioides, Brady, 1884, FC. p. 419, pl. lii, figs. 24, 25.
,, ,, Brady, Parker and Jones, 1888, AB. p. 221, pl. xliii, fig. 1.
,, ,, Millett, 1898, etc., FM. 1900, p. 542, pl. iv, fig. 5.
,, ,, Heron-Allen and Earland, 1908, etc., SB. 1911, p. 316, pl. x, figs. 10–12.
,, ,, Heron-Allen and Earland, 1916, FWS. p. 238, pl. xli, figs. 10–14.
,, *spinescens*, Cushman, 1910, etc., FNP. 1911, p. 46, fig. 76.

Stations 2, 5, 6, 8–11, 55 (+ D.).

Cushman founds his variety upon two of Brady's figures of *B. textilarioides*, Rss. The figures differ from the true Reuss type in the roughness of the sutural depressions. There is no doubt that this rough type is much more widely distributed and abundant than the true *B. textilarioides*, and there would be great difficulty in identifying past records of Reuss's species. But it seems desirable that two forms should be distinguished in future, although we consider them to be very closely allied and not exhibiting greater variation than is recognised in many other species. The N.Z. area furnishes an excellent series of var. *spinescens*, especially at Stations 9, 10, and 11, where the sutural

depressions on the first half of the shell are distinctly granular and the apex and margin often spinous.

245. *Bolivina lobata*, Brady.

Bolivina lobata, Brady, 1879, etc., RRC. 1881, p. 58; 1884, FC. p. 425, pl. liii, figs. 22, 23.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 647.

Stations 4, 6, 7, 8.
Very well developed at Station 6.

246. *Bolivina dilatata*, Reuss.

Bolivina dilatata, Reuss, 1849–50, FOT. p. 381, pl. iii (xlviii), fig. 15.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 645.

Stations 2, 6, 8, 11, 31 (+ R. d. J.).
Curiously rare. The best specimen a solitary Antarctic individual from Station 31; the others far from typical.
[Arenaceous isomorph, *Bolivina arenosa*, Chap. 1895, FAS. p. 24, pl. i, fig. 3.]

247. *Bolivina beyrichi*, Reuss.

Bolivina beyrichi, Reuss, 1851, FSUB. p. 83, pl. vi, fig. 51.
,, ,, Heron-Allen and Earland, 1916, FWS. p. 239, pl. xli, fig. 15.
,, ,, Cushman, 1910, etc., FNP. 1911, p. 34, fig. 56.

Stations 8, 9.
Extremely rare, but typical.

248. *Bolivina beyrichi*, var. *alata* (Seguenza).

Vulvulina alata, Seguenza, 1862, RFC. p. 115, pl. ii, figs. 5, 5*a*.
Bolivina beyrichi, var. *alata*, Brady, 1884, FC. p. 422, pl. liii, figs. 2–4.
,, ,, ,, Bagg, 1912, PFC. p. 40, pl. x, figs. 7–9.

Stations 3, 8.
One large specimen at Station 3, and several very fine examples at Station 8.

249. *Bolivina aenariensis* (Costa).

Brizalina aenariensis, Costa, 1853, etc., PRN. 1856, p. 297, pl. xv, figs. 1, 2.
Bolivina aenariensis, Cushman, 1910, etc., FNP. 1911, p. 44, fig. 71.

Station 6.
The specimens are all very weak.

250. *Bolivina decussata*, Brady.

Bolivina decussata, Brady, 1879, etc., RRC. 1881, p. 58; 1884, FC. p. 423 pl. liii, figs. 12, 13.
,, ,, Cushman, 1910, etc., FNP. 1911, p. 47, fig. 77.

Stations 22.
An unquestionable example.

251. *Bolivina difformis* (Williamson).

Textularia variabilis, var. *difformis*, Williamson, 1858, RFGB. p. 77, pl. vi, figs. 166, 167.
Bolivina pygmaea, Brady, 1884, FC. p. 421, pl. liii, figs. 5, 6.
,, *difformis*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 645.

Stations 8, 9.

A few very good specimens.

252. *Bolivina variabilis* (Williamson).

Textularia variabilis (*typica*), Williamson, 1858, RFGB. p. 76, pl. vi, figs. 162, 163 (incorrectly numbered 161, 162 on the plate).
Bolivina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 647.

Stations 2, 5, 7, 8.

Rare. The best at Stations 2 and 8, quite typical.

253. *Bolivina inflata*, Heron-Allen and Earland.

Bolivina inflata, Heron-Allen and Earland, 1913, CI. p. 68, pl. iv, figs. 16–19; 1915, FKA. p. 648; 1916, FSC. p. 43; 1916, FWS. p. 240.

Stations 4, 5, 6, 9.

Very rare, a few small but typical specimens in the N.Z. area only.

254. *Bolivina inflata*, var. *arenacea*, nov. Pl. IV, figs. 31–33.

At Stations 2 and 6 (N.Z.) and at Station 55 (Ant.) a few minute arenaceous isormorphs were found. They are slightly larger than the hyaline form, but otherwise correspond, except in the constitution of the test, which is built up almost entirely of ferruginous cement in which hardly any trace of mineral grains can be seen under a fairly high power. The shell-wall is extremely thin and delicate.

Size :—Length, ·15 mm.; breadth, ·12 mm.; thickness, ·08 mm.

255. *Bolivina plicata*, d'Orbigny.

Bolivina plicata, d'Orbigny, 1839, FAM. p. 62, pl. viii, figs. 4–7.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 648.

Stations 2, 3, 5, 6, 8–10.

Fairly plentiful, very good and typical specimens at Stations 5 and 6.

256. *Bolivina reticulata*, Hantken.

Bolivina reticulata, Hantken, 1875, CSS. p. 65, pl. xv, fig. 6.
,, ,, Millett, 1898, etc., FM. 1900, p. 547.

Stations 6, 7, 9–11.

The records are few and the specimens are nearer Hantken's original figure than Brady's. With a few exceptions they all represent a variety with a sharply truncate marginal edge, and practically parallel faces. This gives the test a very compressed appearance.

257. *Bolivina karreriana*, Brady.

Bolivina karreriana, Brady, 1879, etc., RRC. 1881, p. 58 ; 1884, FC. p. 424, pl. liii, figs. 19-21.
„ „ Cushman, 1910, etc., FNP. 1911, p. 40, fig. 65.

Stations 4, 6, 8.

Very rare, except at Station 6, where it is abundant and beautifully developed, the apical spine often attaining great length.

258. *Bolivina obsoleta* (Eley).

Textularia obsoleta, Eley, 1859, Geology in the Garden, p. 202, pl. viii, fig. 11c.
„ *quadrilatera*, Schwager, 1886, FKN. p. 253, pl. vii, fig. 103.
„ „ Millett, 1898, etc., FM. 1899, p. 559, pl. vii, fig. 3.
Bolivina obsoleta, Heron-Allen and Earland, 1908, etc., SB. 1910, p. 409.

Station 6.

A very fine series of specimens, all megalospheric. Some of them show a strong tendency to a spiral twist. We see no reason to depart from the opinion we expressed in 1910. Reuss used the name *Textularia obsoleta* (R. 1845–46, FBK. pt. 1, p. 39, pl. xiii, fig. 79) for a species which he admits is probably the same as *T. laevis*, Roemer (R. 1841, VNK. p. 97, pl. xv, fig. 17). They appear to us to be identical, and Reuss's name must therefore lapse.

259. *Bolivina tortuosa*, var. *arenacea*, nov. Pl. IV, figs 34, 35.

Station 2 (+ D.).

A single specimen exhibiting the characteristic flexure of this form, but with a test constructed of very fine sand-grains and ferruginous cement. But for the curve in the axis of growth this form would be inseparable from our *B. inflata*, var. *arenacea*, and raises once more the question of the specific value of *B. tortuosa*, to which we referred under that species in 1916 (H.-A. & E. 1916, FWS. p. 240). The aperture is a small compressed tube (bifarine) at the extremity of the final chamber.

Size :—Length, ·25 mm. ; breadth, ·13 mm.

260. *Bolivina robusta*, Brady.

Bolivina robusta, Brady, 1879, etc., RRC. 1881, p. 57 ; 1884, FC. p. 421, vol. liii, figs. 7, 9.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 646.

Stations 1–3, 6–8, 10, 11, 32 (+ R. d. J.).

Abundant in the N.Z. area, but represented by a single typical specimen only in the Antarctic. At most of the Stations the prevalent type is a very decorative variety with strongly limbate sutural lines which are coarsely perforate, the walls of the chambers themselves being clear and free from perforation. Brady's type without limbation occurs at Stations 6, 10, and 11, with the limbate variety. A very fine series of specimens were obtained at Station 6, 10 and 11, representing both megalospheric and microspheric specimens. At Stations

10 and 11 all the typical non-limbate specimens bear a spine at the initial extremity. At Station 10 the species appears to be subject to great abnormalities. Among the "freaks" observed were many instances of marked depauperation at half growth, succeeded by recovery, giving a lyriform outline to the test. Other instances of spiral twists in the axis, reversed axes, and fracture and repair of the shell, the best instance of which was found at Station 6.

261. *Bolivina limbata*, Brady.

Bolivina limbata, Brady, 1879, etc., RRC. 1881, p. 57; 1884, FC. p. 419, pl. liii, figs. 26–28.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 646, pl. L, figs. 1–4.

Station 2.

A good specimen.

Sub-Family CASSIDULININAE.

CASSIDULINA, d'Orbigny.

262. *Cassidulina laevigata*, d'Orbigny.

Cassidulina laevigata, d'Orbigny, 1826, TMC. p. 282, No. 1, pl. xv, figs. 4, 5.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 652.

Stations 1–9, 11, 27, 31, 48, 55 (+ K. I., R. d. J., D.).

Generally distributed, but never very abundant. The best Stations were No. 6 in the N.Z. area, and Nos. 27, 31 in the Antarctic. The predominant type at all Stations, except Stations 2 and 3, is a sharply-keeled form, Brady's fig. 3 (FC. pl. liv). At Stations 2 and 3 the original form figured in the "Tableau Méthodique" appears in company with the carinate form. At Station 6 a double specimen, due to what, at present, we regard as fusion of primordial chambers.

263. *Cassidulina laevigata*, var. *tumida*, nov. Pl. V, figs 8–10.

Stations 1, 2, 3.

Chambers arranged as in the type, but differing in the structure of the shell, which is strongly biconvex and very thick walled. Sutures obscure but, when visible, strongly limbate. Surface of the shell often slightly rough. Peripheral edge rounded; never keeled.

This variety, which is very distinctive, can hardly be mistaken for the type or any of the many figured forms attributed to *C. laevigata*. The outstanding feature is the extraordinary thickness of the shell-wall, which has the appearance of being deposited in layers, as the latest formed chambers are usually thinner walled and clearly distinguishable in outline, whilst all the earlier ones in the same individual have become almost indistinguishable from one another. It is very local, occurring only at Stations 1, 2 and 3, where, however, it is perhaps more abundant than the typical *C. laevigata*, which also occurs at these Stations.

Size:—Breadth, ·30–·40 mm.; thickness, ·20–·25 mm.

264. *Cassidulina crassa*, d'Orbigny.

Cassidulina crassa, d'Orbigny, 1839, FAM. p. 56, pl. vii, figs. 18–20.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 652.

Stations 1–3, 5–11, 19, 20, 26, 27, 31, 35, 38, 45–50, 53–55 (+ K. I., R. d. J., D.).

Almost universally distributed, and increasing in size and abundance to the South. At the most southerly Stations it reaches an almost unprecedented development in size and thickness of shell, the substance being evidently deposited in layers, as dead specimens show exfoliation of the surface. At Station 3 a double specimen.

265. *Cassidulina oblonga*, Reuss.

Cassidulina oblonga, Reuss (*non* d'Orbigny), 1849–50, FOT. p. 376, pl. iii (xlviii), figs. 5, 6.
„ *crassa* (*pars*), Brady, 1884, FC. p. 429, pl. liv, fig. 4 (only).

Stations 3, 6, 26, 27, 38, 45, 46, 47, 48, 50, 53, 54 (+ D).

This can only be regarded as a modification of the *C. crassa* type, but it possesses an individuality of its own in the tendency to inflation of chambers and the oblong outline of the whole test. It occurs in company with *C. crassa* at many Stations and passage-forms are common. As with *C. crassa* it reaches a maximum development in size at the southerly Stations, the best being at Stations 38, 45 and 54.

266. *Cassidulina subglobosa*, Brady.

Cassidulina subglobosa, Brady, 1879, etc., RRC. 1881, p. 60; 1884, FC. p. 430, pl. liv, fig. 17.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 652.

Stations 1–8, 10, 11, 16, 18–20, 22, 26, 27, 29–31, 36, 38, 45–50, 52–55 (+ T. d. F., K .I., R. d. J., D.).

Almost universally distributed, but, unlike *C. crassa* and *oblonga*, the form does not show that marked tendency to increase in development to the South. There are a few exceptions at Stations 38, 48 and 54, where individuals of very large size occur, but otherwise the Antarctic *C. subglobosa* is in no way different from the N.Z., and as a general rule the specimens are not so well developed as at the best N.Z. Station 6. Passage-forms into *C. crassa* and *oblonga* are frequent. [Arenaceous isomorph. *Cassidulina devonica*, Chap., J.R.M.S. 1922, p. 334, pl. viii, fig. 8.]

267. *Cassidulina subglobosa*, var. *tuberculata*, nov. Pl. IV, figs. 36-38.

Stations 30, 31 (+ D.).

At these Stations a variety of *C. subglobosa*, characterized by the ornamentation of all but the last formed chambers, with minute tubercles of shell-matter, occurred. Decoration of any kind is so rare among the Cassidulinae that this variation, which would pass unnoticed in many other genera, seems worthy of a varietal name in this place. It may be compared with Sidebottom's *C. decorata* (JQMC, Ser. 2, vol. xi,

p. 107, pl. iv, fig. 2), which is merely *C. subglobosa* covered with a reticulate ornament of shell-substance, but much more pronounced than in this tuberculate variety.

Size :—Length, ·40–·50 mm. ; breadth, ·35–·40 mm.

268. *Cassidulina calabra* (Seguenza).

Burseolina calabra, Seguenza, 1879–80, FTR. p. 138, pl. xiii, figs. 7 *a*, *b*.
Cassidulina „ Brady, 1884, FC. p. 431, pl. cxiii, figs. 8, *a–c*.
„ „ Bagg, 1912, PFC. p. 42, pl. xii, figs. 1, *a–c*.

Stations, 2, 3, 6, 18, 22.

The records are few, and the Antarctic ones depend on single specimens at Stations 18 and 22, both deep water. The N.Z. examples are all from the sub-fossilized foraminiferal rock (see Description of Material), from Stations 2, 3 and 6. This seems to be conclusive that these sub-fossilized deposits were not laid down under the same conditions as the recent material from the same Stations.

269. *Cassidulina bradyi*, Norman.

Cassidulina bradyi (Norman MS.), Wright, 1880, NEL. p. 152.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 653.

Stations 1–8 (+ R. d. J.).

Confined to the N.Z. area and fairly plentiful at the Stations where it is found. All the examples belong to the sharp edged, broad type figured by Brady (fig. 10), and, except at Station 6, nearly all the specimens observed show but the feeblest signs of the rectilinear series of chambers ; in fact but for the very characteristic appearance of the wall of the test, as compared with *C. laevigata*, the specimens might have been regarded as a mere variation of that type. At Station 6 the rectilinear series was frequently developed to a much greater length than Brady's figures would indicate, and there is an increasing tendency in the latest formed chambers to lose the sharp marginal edge and to approach the rounded cross-section of Brady's fig. 7. (FC. pl. liv.)

270. *Cassidulina bradyi*, Norman, var. *elongata*, Sidebottom.

Cassidulina bradyi, var. *elongata*, Sidebottom, 1904, etc., RFD. 1905, p. 17, pl. iii, fig. 11.
„ „ „ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 653, pl. L, fig. 20.

Station 55.

A single small but typical specimen from this most southerly point. It is a most interesting "find," in view of the fact that the very few recorded observations now cover the North Sea, the Mediterranean, tropical East Africa and "Farthest South," the only four records in existence.

271. *Cassidulina parkeriana*, Brady.

Cassidulina parkeriana, Brady, 1879, etc., RRC. 1881, p. 59; 1884, FC. p. 432, pl. liv, figs. 11–16.

Stations 5, 6, 27, 31, 38, 45–48, 50, 54 (+ D.).

Very rare in the N.Z. area (only Stations 5 and 6), where the specimens were few and small. At Station 6 the single specimen, though small, had a greater development of the rectilinear series of chambers than was observed anywhere else. In the Antarctic the species is much more abundant, attaining a large size and considerable thickness of shell-wall, but the rectilinear chambers are, as a rule, but short, the specimens being of a stout inflated type similar to Brady's fig. 14. The best individuals at Stations 38, 45, 48 and 50.

272. *Cassidulina nitidula* (Chaster).

Pulvinulina nitidula, Chaster, 1892, FS. p. 66, pl. i, fig. 17.
Cassidulina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 653.

Station 27.

A single typical specimen.

EHRENBERGINA, Reuss.

273. *Ehrenbergina serrata*, Reuss.

Ehrenbergina serrata, Reuss, 1849–50, FOT. p. 377, pl. iii (xlviii), figs. 7, *a–c*.
,, ,, Cushman, 1910, etc., FNP. 1911, p. 101, fig. 155.

Stations 1–3, 6, 8, 17, 18.

This is one of the most typical Foraminifera in the N.Z. area, and at those Stations where it occurs is both abundant and varied, the variation being principally in the development of the spinous margin. The single specimen from the Antarctic is differentiated by the marked development of the spines on the central line, which are generally entirely suppressed in the N.Z. area. Excellent glauconitic casts from Station 6.

274. *Ehrenbergina hystrix*, Brady.

Ehrenbergina hystrix, Brady, 1879, etc., RRC. 1881, p. 60; 1884, FG. p. 434, pl. lv, figs. 8–11.
,, ,, Cushman, 1910, etc., FNP. 1911, p. 102, fig. 156.

Station 18.

The only individuals which agree entirely with Brady's description and figure were found at Station 18; they present the characteristic thickening of the shell with spinulation over the whole of the early chambers.

275. *Ehrenbergina hystrix*, var. *glabra*, nov. Pl. V, figs. 1–6, 11.

Stations 2, 6, 11, 26, 27, 31, 38, 45–48, 50, 53–55 (+ D.).

One of the most typical and abundant forms in the Antarctic is the variety for which we propose this name, on account of its smooth and highly polished surface-texture, and the entire absence of the superficial spines which characterize the early chambers of Brady's type. The variety otherwise bears a strong resemblance

to Brady's figures of *E. hystrix*, notably in the convexity of the dorsal side and the involution of the earlier chambers. The oral face, however, is more flattened than in the type, the aperture is situated nearer to the marginal edge, and the striations round the aperture are often entirely absent and never very marked. The marginal spines vary enormously in development, but, as a rule, are relatively most prominent in small individuals, whereas in the comparatively large specimens which occur at the most southerly Stations they are inconspicuous and in some cases almost or entirely lacking.

Double individuals occur at Station 48. Practically, if not absolutely, all the specimens are very distinctly megalospheric. This brings the form directly into contrast with *E. serrata*. Out of an enormous number of specimens of that species which we have examined, practically all were microspheric; the possibility that our var. may be the megalospheric type of *E. serrata* must not be lost sight of, but against this suggestion may be set the fact that its distribution is markedly Antarctic, the variety being represented by single specimens only at Stations 2, 6 and 11, whereas *E. serrata*, so abundant in the N.Z. area, does not occur in company with var. *glabra*, except at Stations 2, 6, 11 and 18, which latter alone is outside the N.Z. area, and is our most southerly record.

Size:—Length, ·35–·60 mm.; breadth, with spines, up to ·60 mm.; thickness up to ·30 mm.

Family CHILOSTOMELLIDAE.

SEABROOKIA, Brady.

276. *Seabrookia earlandi*, Wright.

Seabrookia earlandi, Wright, 1891, SWI. p. 477, pl. xx, figs. 6, 7.
„ „ Heron-Allen and Earland, 1913, CI. p. 72, pl. v, figs. 10–12.

Stations 6, 8–11, 16, 17, 27, 31, 55 (+ D.).

Occurs in both areas down to the southernmost limit. A good many specimens, the best at Station 10. In the Antarctic, especially at Stations 16 and 27, the type is longer and more milioline than usual, the final chamber in some cases only partially covering its predecessor. In a few instances, in fact, the specimens were practically isomorphs of *Miliolina cultrata*.

277. *Seabrookia pellucida*, Brady.

Seabrookia pellucida, Brady, 1890, JRMS. p. 570, text-figs. 60, 1*a–c*, 2.
„ „ Millett, 1898, etc., FM. 1901, p. 3, pl. i, fig. 4.

Stations 2, 6.

A few specimens of the type figured by Millett without the serrated aboral end. Their occurrence outside the Malay area, to which all previous records refer, is remarkable, if, as seems probable, Brady's reference to its discovery at "Challenger" Station 33 (Bermuda, 435 fms.), is a mistake for the commoner type *S. earlandi*, which he failed to differentiate from his own species.

CHILOSTOMELLA, Reuss.

278. *Chilostomella ovoidea*, Reuss.

Chilostomella ovoidea, Reuss, 1849–50, FOT. p. 380, pl. iii (xlviii), fig. 12.
„ „ Brady, 1879, etc., RRC. 1879, p. 66, pl. viii, figs. 11, 12; 1884, FC. p. 436, pl. lv, figs. 12–23.
„ „ Millett, 1898, etc., FM. 1901, p. 2, pl. i, figs. 2, 3.

Stations 6, 7.

A good many specimens at each Station, attaining a large size. Two forms occur at both Stations, representing the two distinct types figured and recorded by Millett, *ut supra*.

Family LAGENIDAE.

Sub-Family LAGENINAE.

LAGENA, Walker and Boys.

279. *Lagena globosa* (Montagu).

Serpula (*Lagena*) *laevis globosa*, Walker and Boys, 1784, TMR. p. 3, pl. i, fig. 8.
Lagena globosa, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 654.

Stations 2, 3, 6–10, 11, 14, 16–18, 20, 22, 23, 26, 27, 31, 36, 38, 45, 46, 48, 50, 53–55 (+ T. d. F., R. d. J., D.).

Almost universally distributed, as usual, very variable both in size and, within limits, in shape. The finest specimens at Stations 18, 38, 50, 53 and 54. Specimens having an entosolenian tube occur at many Stations, especially Stations 6, 18, 38, 45 and 48, the best at Station 45, where an exceptionally large individual, furnished with a short produced neck at each pole and a straight internal tube running almost across the shell, was found. A gigantic specimen at Station 54. At Station 50 a very large abnormal specimen with a produced neck, similar to fig. 11*k*, in Brady, FC, p. 441. Compressed individuals at many Stations. Double specimens at Stations 7, 9, 10. At Station 7 a pair joined by the apex, at Station 9 a pair joined by the base, and at Station 10 a pair joined base to side. The Antarctic specimens are, as usual, larger than normal, and the surface is marked with excessively fine striae.

280. *Lagena globosa*, var. *lineato-punctata*, nov. Pl. V, figs. 12-14.

Stations 6, 11.

Test globose to pyriform, with slightly protruding neck, and a clear spot of shell-substance in the middle of the base. Surface glassy, but "frosted" in appearance. Under a high magnification this is seen to be due to fine depressions set in close regular lines extending from base to neck. There is no indication that these depressions are perforate.

Several specimens at Station 6. Very rare at Station 11.

Dimensions:—Length, ·20–·27 mm.; breadth, ·17–·20 mm.

281. *Lagena apiculata* (Reuss).

Oolina apiculata, Reuss, 1851, FKL. p. 22, pl. i, fig. 1.
Lagena ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 654.

Stations 1, 2, 6, 17, 23, 27, 31, 38 (+ T. d. F., D.).

This pointed variety of *L. globosa* is much rarer than the type. Very fine specimens at Stations 23, 27 and 31.

[Arenaceous isomorph, *Reophax difflugiformis*, Brady (*pars*), = *R. ovulum*, Grzbw., 1895, OWI., and *Haplophragmium lagenarium*, Berthelin (B., 1880, EAM. p. 21, pl. i., fig. 2).]

282. *Lagena longispina*, Brady.

Lagena longispina, Brady, 1879, etc., RRC, 1881, p. 61 ; 1884, FC. p. 454, pl. lvi, figs. 33, 36, pl. lix, figs. 13, 14.
,, ,, Sidebottom, 1912, etc., LSP. 1913, p. 165, pl. xv, figs. 5, 6.

Stations 17, 20, 36.

Very rare, and, excepting at Station 20, small. The spines range between two and three in number and are very long.

283. *Lagena ovum* (Ehrenberg).

Miliola ovum, Ehrenberg, 1843, MMO. p. 166 ; 1854, M. pl. xxiii, fig. 2, pl. xxix, fig. 45, pl. xxxi, fig. 4.
Lagena ,, Heron-Allen and Earland, 1913, CI. p. 73, pl. vi, fig. 1.

Station 36.

Several typical individuals.

284. *Lagena botelliformis*, Brady.

Lagena botelliformis, Brady, 1879, etc., RRC. 1881, p. 60 ; 1884, FC. p. 454, pl. lvi, fig. 6.
,, ,, Millett, 1898, etc., FM. 1901, p. 492, pl. viii, fig. 15.

Stations 6, 9–11, 16–18, 20, 22, 27, 31, 36 (+ T. d. F., D.).

Widely distributed, especially in the deep-water Stations, the best at Stations 16, 17 and 36. Those from the N.Z. area are less distinctive, but good at Station 11. An apiculate form occurs at Station 9.

285. *Lagena laevis* (Montagu).

Vermiculum laeve, Montagu, 1803, TB. p. 524.
Lagena laevis, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 657.

Stations 2, 6–8, 10, 11, 16–18, 22, 26, 36 (+ K. I., D.).

Generally distributed as far south as Station 36, often frequent. There is an enormous range of variations, the usual tendency to the production of a very long neck in deep water being observable. The best of this latter type, in which the body ranges from nearly globular to oval or cylindrical, are at Stations 16, 17 and 22. At Stations 16 and 22 the specimens are very delicately spinous

round the neck, and show evidence of the same ornament sometimes on the body. These specimens might, perhaps, be equally well referred to *L. hispida*, representing a maximum stage of denudation, as referred to in our note on that species (see H.-A. & E., 1916, FWS. p. 243, pl. xli, fig. 16, *L. hispida*), but only these vestigial traces would suggest that they were anything but typical *L. laevis*.

[Arenaceous isomorph, *Reophax difflugiformis*, Brady.]

286. *Lagena sphaerula*, Silvestri.

Lagena sphaerula, Silvestri, 1902, LMT. p. 162, figs. 68–70.

Stations 2, 6.

Many excellent examples at Station 6, and one at Station 2. This form of Silvestri's with oral and basal produced apertures is isomorphous with Seguenza's *L. lyellii*, and occupies the same varietal position towards *L. laevis* that *L. lyellii* does to *L. sulcata*.

287. *Lagena gracillima* (Seguenza).

Amphorina gracilis, Costa, 1853, etc., PRN. 1856, p. 121, pl. xi, fig. 11.
Lagena gracillima, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 660.

Stations 2, 6, 9, 10, 16, 18, 20, 22, 29, 36 (+ K. I.).

Widely distributed but never abundant. The best specimens at Station 6, very large, and Station 36 medium in size, but with extraordinarily produced neck.

288. *Lagena elongata* (Ehrenberg).

Miliola elongata, Ehrenberg, 1844, Ber. k. preuss, Ak. Wiss. Berlin, p. 274; 1845, p .371; 1854, M. pl. xxv, fig. 1, A, 1.
Lagena ,, Cushman, 1910, etc., FNP. 1913, p. 12, pl. 1, fig. 5.

Stations 6, 11, 17, 36.

Typical at Station 11, though small; less characteristic and nearer *L. gracillima* at the other Stations.

289. *Lagena aspera*, Reuss.

Lagena aspera, Reuss, 1861, FKM. p. 305, pl. i, fig. 5.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 655.

Stations 6, 10, 16–18, 22, 28.

Sparingly distributed, and only occasional specimens, but very representative. At Station 6 long-necked specimens of all degrees of coarseness of ornament. At Station 7 a globular specimen almost identical with Reuss's *L. rudis* (R. 1862, FFL. p. 336, pl. vi, fig. 82). At Stations 16, 17 and 22, the specimens are of the type usually associated with deep water, having a globular body and a short, thick neck ornamented with rings.

[Arenaceous isomorph, *Haplophragmium scruposum*, Berthelin (B. 1880, EAM. p. 21, pl. i, fig. 1).]

290. *Lagena ampulla-distoma*, Rymer Jones.

Lagena vulgaris, var. *ampulla-distoma*, Rymer Jones, 1872, LJS. p. 63, pl. xix, fig. 52.
„ *ampulla-distoma*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 655.

Station 6.

Typical, but very rare.

291. *Lagena hispida*, Reuss.

Lagena hispida, Reuss, 1858, FP. p. 434; 1862, FFL. p. 335, pl. vi, figs. 77–79.
„ „ Heron-Allen and Earland, 1916, FWS. p. 243, pl. xli, fig. 16.

Stations 7, 8, 10, 11, 16, 18–20, 22, 23, 31, 36.

More widely distributed and abundant than *L. aspera*, and characterised by considerable variation, chiefly in the length of the neck which, in the deep-water Stations 16, 18, 19, 20, is very pronounced. Specimens with a complete armature of long fine spines, such as we find in the North Sea, do not occur. The spines as a rule are very short, sometimes amounting to nothing more than a matt surface to the test. At Station 16 some abnormal individuals isomorphous with *L. apiculata* and finely hispid were found.

292. *Lagena clavulus*, sp. nov. Pl. V, fig. 7.

Station 29.

Test elongate, pyriform, without a produced neck. The entire surface closely covered with bolt-like projections of uniform length, set in close parallel rows in the direction of the long axis of the test. Every protuberance has a slightly swollen extremity like the head of a nail, flat upon the outer surface.

Dimensions :—Length, ·25 mm. ; breadth, ·12 mm.

The species is based on a single individual which is, however, so characteristic in appearance as to deserve special notice. It may be merely a highly distinctive variation of *L. hispida*, or it may represent a form in process of transition into the group of double-walled Lagenae of the *L. foveolata* group. There are faint indications of a delicate pellicle between some of the "studs" which give support to the latter theory.

293. *Lagena striata* (d'Orbigny).

Oolina striata, d'Orbigny, 1839, FAM. p. 21, pl. v, fig. 12.
Lagena „ Brady, 1884, FC. p. 460, pl. lvii, figs. 22, 24, 28, 29, etc.
„ „ Millett, 1898, etc., FM. 1901, p. 487.

Stations 2, 6–8, 11, 17, 22, 48, 55 (+ R. d. J.).

Ranges over the entire series of Stations. The best at Stations 6 and 7. Examples with a spinous base at Station 17. Very small at Station 55. At Station 48 a variety occurs in which certain of the costae are developed to a greater extent than the intervening ones, so as to separate the shell into a

septangular striate figure comparable with Sidebottom's figure (S. 1912, etc., LSP. 1912, p. 386, pl. xv, fig. 7), which has, however, only five prominent costae.

294. *Lagena lineata* (Williamson).

Entosolenia lineata, Williamson, 1848, BSGL. p. 18, pl. ii, fig. 18.
Lagena ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 656.

Stations 27, 38, 54.

Few records, best and most typical at Station 38. Coarsely striate at Station 27, and feebly so at Station 54.

295. *Lagena sulcata* (Walker and Jacob).

Serpula (*Lagena*) *striata sulcata rotundata*, Walker and Boys, 1784, TMR. p. 2, pl. i, fig. 6.
Lagena sulcata, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 659.

Stations 2–4, 6–11, 16–19, 22, 27, 28, 36, 45 (+ K. I., R. d. J., D.).

Widely distributed, the best at Stations 2, 6 and 45. At the deep-water Stations the form has a tendency to narrow, and to merge into *L. gracilis*. Spinous-based individuals occur at Stations 18, 19 and 36, at the last of which the spine is almost as long as the neck. At Station 16 the costae are developed very highly, standing out as wings. At Station 10 the examples have a very long neck, and at Station 45 this neck bears a spiral band of shell-substance. Williamson's variety *interrupta* occurs at Stations 7 and 22.

296. *Lagena lyellii* (Seguenza).

Amphorina lyellii, Seguenza, 1862, FMMM. p. 52, pl. i, fig. 40.
Lagena ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 659.

Stations 2, 5, 6, 20 (+ R. d. J.).

Frequent and typical but confined to few Stations, only one of which is Antarctic.

297. *Lagena acuticosta*, Reuss.

Lagena acuticosta, Reuss, 1862, FFL. p. 331, pl. v. fig. 63.
,, ,, Brady, 1884, FC. p. 464, pl. lvii, figs. 31, 32, pl. lviii, figs. 20, 21.
,, ,, Millett, 1898, etc , FM. 1901, p. 8.

Stations 6, 7, 10, 11, 16–19, 22, 23, 26, 31, 36, 38, 52, 55.

Widely distributed. Typical and fairly plentiful where it occurs, the best at Stations 10 and 11.

298. *Lagena williamsoni* (Alcock).

Entosolenia williamsoni, Alcock, 1865, NHC. p. 195.
Lagena ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 659.

Stations 2, 3, 8, 10 (+ K. I.).

Very rare. and except at Stations 8 and 10 the specimens are not very typical.

299. *Lagena costata* (Williamson).

Entosolenia costata, Williamson, 1858, RFGB. p. 9, pl. i, fig. 18.
Lagena ,, Heron-Allen and Earland, 1914, FKA. 1915, p. 656.

Stations 2, 3, 5–7, 10, 11, 17, 18, 20, 22, 23, 26, 27, 31, 36, 38, 45, 53, 55 (+ T. d. F.).

Widely distributed and fairly common. The best N.Z. at Station 6. Weak and small at Stations 17, 26, and 36. Increasing in size at the southerly Stations. Very fine specimens at Stations 38, 45, 53 and 55.

300. *Lagena gracilis*, Williamson.

Lagena gracilis, Williamson, 1848, BSGL. p. 13, pl. i, fig. 5.
,, ,, Brady, 1884, FC. p. 464, pl. lviii, figs. 2, 3, 7–10, 19, 22–24.
,, ,, Millett, 1898, etc., FM. 1901, p. 492, pl. viii, figs. 12–14.

Stations 3, 9, 10, 11, 16–18, 20, 22, 23, 27, 31, 36, 55 (+ T. d. F., D.).

Generally distributed, but does not occur after Station 36 till we reach the extreme south at Station 55. Usually abundant and often very variable. The coarsely costate type, on the whole, predominates, but at the most representative Stations 16, 18 and 36, both coarsely and finely marked types occur in company. In the deep-water Stations the coarsely costate form often acquires extensive wing-like development of the costae.

301. *Lagena plumigera*, Brady.

Lagena plumigera, Brady, 1879, etc., RRC. 1881, p. 62 ; 1884, FC. p. 465, pl. lviii, figs. 25, 27.
,, ,, Millett, 1898, etc., FM. 1901, p. 490, pl. viii, fig. 8.

Stations 11, 14, 16.

Very rare except at Station 16, where a number of magnificent specimens were found rivalling even Haeckel's remarkable figure in beauty (Kunstformen der Natur, Leipzig, 1899. Pl. lxxxi, fig. 10). The spaces between the tubulated wings are sometimes smooth, but at others more or less strongly sulcate.

302. *Lagena semistriata*, Williamson.

Lagena striata, var. *semistriata*, Williamson, 1848, BSGL. p. 14, pl. i, figs. 9, 10.
,, *semistriata*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 658.

Stations 6, 7, 11, 31.

Few records and the specimens rare, but varying greatly in the development of the ornament. At Station 6 the individuals are large, but the ornament is confined to a small radiating star on the rounded base. At Station 7 the specimens have very long necks but weak costae, at Station 11 the costae are raised almost into wings and the neck, which is very long, is strengthened with a spiral band of shell-substance. At Station 31 a single neckless specimen, globular, and covered as to its lower half with innumerable fine costae.

303. *Lagena multicosta* (Karrer).

Fissurina multicosta, Karrer, 1877, HW. p. 379, pl. xvi, fig. 20.
,, *bouei*, *Ibid.* p. 378, pl. xvi, fig. 19.
Lagena multicosta, Brady, 1884, FC., p. 466, pl. lxi, fig. 4.
,, ,, Millett, 1898, etc., FM. 1901, p. 495, pl. viii, fig. 17.

Station 36.

Some fine individuals of the "fissurine" form with abnormally developed costae on the basal half, the superior half of the shell being smooth.

304. *Lagena stelligera*, Brady.

Lagena stelligera, Brady, 1879, etc., RRC. 1881, p. 60; 1884, FC. p. 466, pl. lvii, figs. 35, 36.
,, ,, Sidebottom, 1912, etc., LSP. 1912, p. 391, pl. xv, figs. 28, 29; pl. xvi, figs. 1–4; 1913, p. 174.

Stations 10, 16–19, 23, 36 (+ T. d. F., K. I., D.).

Presenting great variation, both in length of neck, development of the basal cup, rotundity and compression, smoothness and striation, and coarseness of sulcae. The best at Station 36, where practically every development occurs.

305. *Lagena stelligera*, var. *excentrica*, Sidebottom.

Lagena stelligera, var. *excentrica*, Sidebottom, 1912, etc., LSP. 1912, p. 392, pl. xvi, figs. 5, 6; 1913, p. 175, pl. xv, figs. 30, 31.

Stations 11, 36 (+ T. d. F.).

Two very fine and typical specimens of the round form at Station 36. At Station 11, two specimens of the compressed form; at this Station it occurs in company with our new var. *L. danica* var. *pendulum*, to which it bears considerable resemblance, but differs in the character of the aperture. Sidebottom's variety has a short, thick neck tapering into the body of the shell, whereas *L. danica* var. *pendulum* has a thin neck attached to a globular body, with a thin flange running from the top of the neck to the widest part of the shell.

306. *Lagena stelligera*, var. *nelsoni*, nov. Pl. V, figs. 20–22.

Stations 27, 45, 47, 48, 53.

Test, an irregular compressed oval, with prominent basal ring extending to, and enclosing, a considerable area. At the oral end, and set to one side of the middle axis of the shell, a solid bead of shell-substance projects like a beak and includes the aperture, from which a very long and curving entosolenian tube extends backwards and then downwards almost to the base of the shell. Shell-wall in living specimens extremely glassy and transparent, becoming opalescent in dead shells. The mass of orange-yellow protoplasm is large and often occupies, in the dried state, about a third of the internal cavity.

Dimensions:—Length, ·20–·35 mm., breadth, ·18–·32 mm.

This is a very distinctive and excentric type, occurring at several of the Antarctic Stations, usually one or two specimens at each, but more abundantly

at Station 53. It is difficult to describe, on account of its abnormal features, but may best be compared to the head of a short-billed aquatic bird. We have pleasure in associating the variety with the name of Mr. Nelson, by whom the material was collected.

307. *Lagena crenata*, Parker and Jones.

Lagena crenata, Parker and Jones, 1865, NAAF. p. 420, pl. xviii, fig. 4.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 658.

Station 6.

Three quite typical individuals of the small, thick-walled form.

308. *Lagena exsculpta*, Brady.

Lagena exsculpta, Brady, 1879, etc., RRC. 1881, p. 61 ; 1884, FC. p. 467, pl. lviii, fig. 1 ; pl. lxi, fig. 5.
„ „ Cushman, 1910, etc., FNP. 1913, p. 28, pl. xiii, fig. 5.

Stations 16–18, 31 (+ T. d. F.).

Occurs only at the three deep-water Stations, and at one other. With one exception all are of the compressed form figured by Brady, and having a slight median keel round the base. This keel, in the specimen from Station 17, is bifid in the centre of the base, and then curves up slightly at diverging angles. At Station 18 a slightly hispid specimen, and at this Station the only non-compressed specimen, which is much longer and narrower than Brady's figure.

309. *Lagena striato-punctata*, Parker and Jones. Pl. VI, figs. 5, 19.

Lagena sulcata, var. *striato-punctata*, Parker and Jones, 1865, NAAF. p. 350, pl. xiii, figs. 25-27.
„ *striato-punctata*, Heron-Allen and Earland, 1914, etc., FKA. 1915 p. 660.

Stations 6–10, 16, 17, 36, 38.

Generally distributed but never very abundant. Usually of a long-necked type. At Station 38 the species attains a gigantic size with corresponding development of markings. It becomes obvious that the ribs are solid structures with cells sunk in them at regular intervals throughout their length, the surface being covered with a very delicate outer shell. The structure bears considerable resemblance to that described in our new species, *L. scottii*. At Station 6 an individual was found in which the raised costae were broad and flat and decorated with a double row of pores. At the same Station a *Lagena* was found with a glassy fusiform body, showing bands of denser shell-substances, each band consisting of two parallel rows of dots ; it seems probable that this may be an abnormal *L. striato-punctata*, in which the costae have never been developed.

310. *Lagena desmophora*, Rymer Jones.

Lagena vulgaris, var. *desmophora*, Rymer Jones, 1872, LJS. p. 54, pl. xix, figs. 23, 24.
„ *desmophora*, Brady, 1884, FC. p. 468, pl. lviii, figs. 42. 43.
„ „ Cushman, 1910, etc., FNP. 1913, p. 27, pl. xii, fig. 5 ; pl. xiii, fig. 3.

Station 18.

A single large thick-walled specimen with basal spine. Between each of the primary tubulated costae is a series of three irregularly anastomosing costae. Cushman's 1913 figure (pl. xiii, fig. 3) comes nearer to our specimen than any other published figure.

311. *Lagena foveolata*, Reuss.

Lagena foveolata, Reuss, 1862, FFL. p. 332, pl. v, fig. 65.
„ „ Millett, 1898, etc., FM. 1901, p. 11, pl. i, fig. 15.

Stations 8, 11, 17, 36 (+ D.).

A single specimen at each Station. Typical at Station 36; very coarsely marked at Station 8, each internal chamberlet being recognisable as a distinct square, sealed by the delicate outer shell. The specimen at Station 17 is very weak, the cross bars between the longitudinal ribs forming the internal shell-wall, being almost non-existent. At Stations 8 and 11 specimens with a single spine at the base exactly resembling Sidebottom's fig. 16 (1912, LSP. pl. xvi).

312. *Lagena foveolata*, var. *spinipes*, Sidebottom.

Lagena foveolata, var. *spinipes*, Sidebottom, 1912, etc., LSP. 1912, p. 395, pl. xvi, figs. 18–21; 1913, p. 177.

Stations 17, 18, 36.

Very few individuals, all very much decayed, the double shell-wall having almost entirely disappeared, leaving only the longitudinal ribs, which project round the produced neck as sharp knife-like flanges. They are clearly referable to Sidebottom's fig. 18.

313. *Lagena foveolata*, var. *paradoxa*, Sidebottom.

Lagena foveolata, var. *paradoxa*, Sidebottom, 1912, etc., LSP. 1912, p. 395, pl. xvi, figs. 22, 23; 1913, p. 177, pl. xv, fig. 32.

Station 20.

A single typical specimen. The outer layer of the shell-wall is eroded in places, and indicates that the inner spongy layer is of great thickness. The central cavity cannot occupy more than a half of the bulk of the shell.

314. *Lagena spumosa*, Millett.

Lagena spumosa, Millett, 1898, etc., FM. 1901, p. 9, pl. i, fig. 9.
„ „ Heron-Allen and Earland, 1916, FWS. p. 245, pl. xli, figs. 19, 20.

Stations 16–18, 36 (+ D.).

Confined to the deepest waters; a few good specimens at each Station.

315. *Lagena scottii*, sp. nov. Pl. VI, figs. 3, 4.

Station 45.

Test pyriform, with short stout produced neck, furnished with spiral groovings. Shell-wall, double. The appearance of the outer surface is that of a highly

polished glass bottle, with a fine white netting lining the inner surface. Covered with closely set incisions disposed in a more or less spiral direction down the shell, each incision lying transversely across one of the meshes of the net. This is probably an optical effect only. Seen under a moderately high power the double wall is seen to consist of irregularly hexagonal chambers, lying between the outer and inner shell-walls, and apparently each chamberlet contains a separate vesicle of extremely delicate membrane. We suppose that the reflection and refraction of the light between these different layers is responsible for the appearance of the incisions, for we have been unable to demonstrate any opening in the outer membrane of the wall.

This is a large and very striking organism, differing entirely from any of the other double-walled Lagenae. Unfortunately only two specimens were found.

Dimensions :—Length, ·80–·83 mm. ; breadth, ·40–·45 mm.

We have two fossils from Cape Otway (Australia), reported as being Eocene, which probably are referable to this species. The individuals are smaller than the recent type, and have lost the glassy characteristic of the "Terra Nova" specimens, the surface being dull, but the double wall, the hexagonal internal mesh, and the delicate transparency of the outer wall remain obvious. The internal vesicles cannot be demonstrated in these specimens, but there is some tendency to show the "incision" markings of the decoration.

316. *Lagena squamosa* (Montagu). Pl. VI, figs. 1, 2.

Vermiculum squamosum, Montagu, 1803–8, TB. p. 526, pl. xiv, fig. 2.
Lagena squamosa, Cushman, 1910, etc., FNP. 1913, p. 16, pl. vi, fig. 1.

Stations 1, 2, 4–6, 8, 11, 16, 19, 27, 38, 48 (+ K. I., R. d. J.).

The majority of records are from the N.Z. area, where it is common. In addition to the typical form which occurs at Stations 2, 5, 6 and 8, there is a strongly costate thick-shelled form occurring at most of the N.Z. Stations, in which the squamose markings between the costae are variable in position, number and strength ; indeed, the most frequent form in the N.Z. area is a costate *Lagena*, which, by the presence of more or less frequent cross markings between the costae, indicates its close relationship to *L. squamosa*. Outside the N.Z. area the records are few and the specimens far from satisfactory. At Station 27 they approach *L. catenulata*, at Station 38 they are typical but weak. At Station 48, however, a single typical individual was found.

317. *Lagena squamoso-sulcata*, sp. nov. Pl. V, figs. 15, 19.

Lagena melo (intermediate var.), Brady, Parker and Jones, 1888, AB. p. 237, pl. xliv, fig. 25.

Stations 27, 38, 48, 50.

Brady, Parker and Jones (*ut supra*) figure a specimen which may be described roughly as *L. squamosa* so far as the oral half of the shell is concerned, and

L. costata as regards the basal half. They do not refer to it in their text, and in the description of the plate it is merely referred to as an intermediate variety of *L. melo*, d'Orb. Identical specimens occur in the Antarctic area, and in these circumstances Brady's figure can no longer be regarded as a freak, but must be given a definite name. The best specimens were from Stations 48 and 50.

Size :— Length, ·45 mm. ; breadth, ·30 mm.

318. *Lagena melo* (d'Orbigny).

Oolina melo, d'Orbigny, 1839, FAM. p. 20, pl. v, fig. 9.
Entosolenia squamosa, var. *catenulata*, Williamson 1848, BSGL. p. 19, pl. ii, fig. 20.
Lagena melo, Millett, 1898, etc., FM. 1901, p. 8.

Station 6.

A few fairly representative specimens and one typical.

319. *Lagena catenulata*, Reuss. Pl. V, figs. 16–18.

[Not *Entosolenia squamosa*, var. *catenulata*, Williamson, 1848, BSGL. p. 19, pl. ii, fig. 20.]
Lagena catenulata, Reuss, 1862, FFL. p. 332, pl. vi, fig. 75 (only).
,, ,, Cushman, 1910, etc., FNP. 1913, p. 18, pl. vii, figs. 1, 2.

Stations 16, 18, 31, 36.

Williamson's variety of *L. squamosa*, var. *catenulata*—and his figure, agree with *L. melo*, d'Orbigny. His authorship therefore lapses in favour of Reuss, whose fig. 75 of *L. catenulata*, Williamson, represents a different test, which is the one now before us. Reuss's figure represents a shell with a limited number of costae (12–14 in number) between which are a limited number of depressed cross-bars.

Reuss's form is quite distinctive ; it differs from *L. melo* in the depression of the cross-bars and their fewness, and from *L. squamosa* in the rectangular spaces thus produced. Judging by the "Terra Nova" material, *L. catenulata* replaces *L. squamosa* in deep-water. Very fine and typical specimens occur at Stations 16 and 18, less strongly marked individuals at Stations 31 and 36.

320. *Lagena reticulata* (Macgillivray).

Lagenula reticulata, Macgillivray, 1843, HMAA. p. 38.
Lagena ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 656.

Stations 6, 16, 31.

Rare everywhere, fine and typical at Station 6. Large and weak at the other stations.

321. *Lagena hexagona* (Williamson).

Entosolenia squamosa, var. *hexagona*, Williamson, 1848, BSGL. p. 20, pl. ii, fig. 23.
Lagena hexagona, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 656.

Stations 2, 6, 9, 10, 11, 16, 18,–20, 22, 23, 27, 31, 36 (+ R. d. J., D.).

Generally distributed, but not observed south of Station 36. There is the usual wide range of variation, both in form of test, prolongation of neck, and

the size and regularity of the hexagonal markings. It reaches its finest development in the deep-water Stations, between Stations 16 and 22, where it attains considerable size, and the hexagonal reticulation is large and strongly developed. The best individuals occur at Stations 23, 27 and 31.

322. *Lagena seminuda*, Brady.

Lagena seminuda, Brady, 1884, FC. p. 472, pl. lviii, fig. 34.
,, ,, Jones, Parker and Brady, 1866, etc., MFC. 1895, p. 194, pl. vi, fig. 8.

Station 17.

Two very fine specimens.

323. *Lagena protea*, Chaster.

Lagena protea, Chaster, 1892, FS. p. 62, pl. i, fig. 14.
,, ,, Sidebottom, 1904, etc., RFD, 1906, p. 15, pl. ii, fig. 18; 1912, etc., LSP. 1912, p. 427; 1913, p. 203.
,, ,, Heron-Allen and Earland, 1913, CI. p. 74, pl. vii, figs. 19, 20.
,, *hispidipholus*, Pearcey, 1914, SNA. p. 1,020, pl. ii, figs. 11–13.

Station 53.

Two large specimens from almost farthest South, one presenting a single aperture, the other several, surface comparatively smooth. While generally agreeing with Chaster's opinion quoted by Sidebottom, *ut supra* (1912, p. 427), we believe that *L. protea*, like many other Lagenae, has a tendency to produce a secondary aperture or apertures. The species was referred to *Ramulina* by Jones and Chapman (J. & C. 1896–8, FPR. 1898, p. 342, fig. 11), but its referability to *Lagena* was fully discussed in the letter of Chaster to Sidebottom, cited in his paper (*ut supra*). We have no hesitation in ascribing Pearcey's *L. hispidipholus* to this form.

324. *Lagena laevigata* (Reuss).

Fissurina laevigata, Reuss, 1849–50, FOT. p. 366, pl. i (xlvi), fig. 1.
Lagena ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 661.

Stations 2, 3, 5, 6–12, 14, 16–20, 23, 26, 27, 29, 31, 36–38, 46–48, 53–55 (+ T. d. F., R. d. J., D.).

Almost universally distributed, but attaining its best development at the deep-water Stations. In addition to the usual type, two punctate or coarsely perforate, and finely perforate forms occur. The coarsely punctate form is most typical in the N.Z. area (Stations 2 and 3), but it occurs also at Station 53. The finely punctate form is more abundant in the deep-water Stations, but also occurs in the circum-polar Stations, especially Station 53. There is the usual wide variation in the comparative length and breadth of the shell, exceptionally long specimens at Station 26.

[Arenaceous isomorph, *Reophax ampullacea*, Brady (*pars*) = *R. lageniformis*, Chap. (C. 1891, etc., GF. 1892, p. 1, pl. v, fig. 1).]

325. *Lagena ventricosa*, Silvestri.

Lagena ventricosa, Silvestri, 1903, PM. p. 10, figs. 6, *a–c*.
„ „ Chapman, 1910, FOF. p. 410, pl. liv, fig. 9.

Stations 20, 27.

This hooded and swollen form of *L. laevigata* occurs at these Stations. It may possibly have been overlooked at other Stations.

326. *Lagena acuta* (Reuss).

Fissurina acuta, Reuss, 1858, FP. p. 434; and Reuss, 1862, FFL. p. 340, pl. vii, figs. 90, 91.
Lagena acuta, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 661.

Stations 6, 9, 16, 18, 19, 22, 23, 36, 55 (+ D.).

Rare, but extending over all the areas. As a rule quite typical, the best specimens at Station 36. At Station 23 the type is long, at Station 16, in addition to typical forms, a thick-walled, coarsely punctate form occurs.

327. *Lagena staphyllearia* (Schwager).

Fissurina staphyllearia, Schwager, 1866, FKN. p. 209, pl. v, fig. 24.
Lagena „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 664.

Stations 8, 11, 17, 19, 23, 26, 27, 31, 36 (+ K. I., D.).

Occurs in all three areas, but in all sparingly, and not south of Station 36. The spinous development is rather poor and as a rule rarely exceeding three spines, situated at equal spaces at the aboral edge. At Station 8 the specimens are two-spined, and also at Station 23, where the spines are very long. At Station 36 the spines are long and the surface of the test shows fine striation.

L. staphyllearia does not appear to be more than a spinous form of several closely-allied Lagenae, viz., *laevigata*, *marginata* and *quadricostulata*. All the specimens might be so described.

328. *Lagena unguiculata*, Brady.

Lagena unguiculata, Brady, 1879, etc., RRC. 1881, p. 61; 1884, FC. p. 474, pl. lix, fig. 12.
„ „ Sidebottom, 1912, etc., LSP 1912, p. 404, pl. xvii, fig. 25; 1913, p. 185.

Station 27.

Two good and typical specimens.

329. *Lagena lucida* (Williamson).

Entosolenia marginata, var. *lucida*, Williamson, 1858, RFGB. p. 10, pl. i, figs. 22, 23.
Lagena lucida, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 661.

Stations 6, 8, 10, 11, 27, 47 (+ R. d. J.).

Very sparingly distributed and, with the exception of two Stations, confined to the N.Z. area, where it is frequent and very typical, especially at Station 6. The Antarctic specimens are smaller, less distinctive and very thin walled.

330. *Lagena annectens*, Burrows and Holland.

Lagena annectens, Burrows and Holland, in Jones, Parker and Brady, 1866, etc., MFC. 1895, p. 203, pl. vii, fig. 11.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 662.

Stations 1–3, 6, 8, 10–12, 31, 47 (+ D.).

Occurs in the N.Z. and Antarctic areas, but nowhere in deep water, or in any abundance. The best at Station 6, where a variety with clouded spaces in the clear shell-substance occurs. A pedunculate specimen at Station 10. Good individuals at Station 31 in the Antarctic.

331. *Lagena fasciata* (Egger).

Oolina fasciata, Egger, 1857, MSO. p. 270, pl. i (v), figs. 12–15.
Lagena „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 662.

Stations 6, 10.

Rare, but good specimens at Station 10.

332. *Lagena fasciata*, var. *faba*, Balkwill and Millett.

Lagena faba, Balkwill and Millett, 1884, FG. p. 81, pl. ii, fig. 10.
Lagena fasciata, var. *faba*, Heron-Allen and Earland, 1913, CI. p. 84.

Stations 2, 6, 27.

Sparingly represented but typical. At Station 6 a large and abnormal specimen characterized by the broad and turgid aboral extremity sloping away towards the aperture, suggesting a hand-bag.

333. *Lagena reniformis*, Sidebottom.

Lagena reniformis, Sidebottom, 1912, etc., LSP. 1913, p. 204, pl. xviii, figs. 14, 15.
„ „ Heron-Allen and Earland, 1916, FWS. p. 255, pl. xli, figs. 30–34.

Stations 8, 38.

A single typical specimen at Station 8 and a very large and fine one at Station 38.

334. *Lagena malcomsonii*, Wright.

Lagena laevigata, var. *malcomsonii*, Wright, 1910–11, BCNI. p. 4, pl. i, figs. 1, 2.
Lagena malcomsonii, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 662.

Stations 2, 3, 5, 6, 8, 17.

With the exception of one typical specimen from deep water at Station 17, all the specimens are from the N.Z. area, where they are typical but never frequent.

335. *Lagena quadrata* (Williamson).

Entosolenia marginata, var. *quadrata*, Williamson, 1858, RFGB. p. 11, pl. i, fig. 27.
Lagena quadrata, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 662.

Stations 2, 3, 6, 8.

Confined to the N.Z. area. Frequent and typical, the best at Station 6. The marginal keel is very often thick. At Station 8, in addition to the type, a variety occurs in which the central area is raised abruptly so that the marginal edge projects as a sharp flange round an oblong box. It is very near the form recorded by Millett from the Malay Archipelago (FM. 1901, pl. viii, fig. 18). At Station 6 the very long parallel-sided type figured by Sidebottom (S. 1910, RFBP. p. 18, pl. ii, fig. 8), from Palermo was found.

336. *Lagena forficula*, Heron-Allen and Earland.

Lagena forficula, Heron-Allen and Earland, 1913, CI. p. 87, pl. vi, fig. 11.

Station 36.

Two specimens from this Station. The remarkable depth (2,216 fms.) contrasts strongly with the shallow water British record.

337. *Lagena schlichti* (Silvestri).

Fissurina carinata (pars), Reuss, 1870, FSP. p. 469. (See Schlicht, 1870, FSP. pl. v, figs. 1–3.)
Fissurina schlichti, Silvestri, 1902, LMT. p. 143. Text-figs. 9–11.
Lagena ,, Chapman, 1909, SNZ. p. 337, pl. xv, figs. 7, *a*, *b*.

Stations 6, 9, 10, 12, 16–18, 20.

Typical and often abundant in the N.Z. and deep-water areas, especially at Stations 6, 10, 12 and 17.

338. *Lagena marginata* (Walker and Boys). Pl. V, fig. 23.

Serpula (*Lagena*) *marginata*, Walker and Boys, 1784, TMR. p. 2, pl. i, fig. 7.
Lagena marginata, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 663.

Stations 2, 3, 5, 6, 7, 10–12, 17–19, 22, 23, 26, 27, 31, 36, 38, 45, 48, 53, 55 (+ K.I., D.).

Universally distributed. In the N.Z. area most abundant at Station 6, where every variation in the rotundity of the test and the breadth of the keel occurs. In the deep-water area, best at Station 17, characterized by both broad and medium keels, but very good at all the deep-water Stations. In the Antarctic, best at Station 27, where the specimens are abundant and varied, including large individuals, without keel; these are also noted from Kerguelen Island in our Appendix B. Trigonal and quadrigonal specimens at Station 27. At Station 31 very good specimens, but many showing clearly parasitic borings. At Station 36 one broken specimen of enormous size; at Station 38 the specimens are all very large with narrow keels. In the circum-polar Stations all the individuals are comparatively small but typical.

At Station 36 a specimen ·12 mm. long is recorded (pl. v, fig. 23) exhibiting a broad keel broken up into a serrate edge extending over the basal half of the

shell only, the rest of the edge being rounded. We figured a rather similar specimen from the West of Scotland, but in that case the keel extended unbroken round the remainder of the shell (H.-A. & E. 1916, FWS. p. 251, pl. xli, fig. 26).

[Arenaceous isomorph of keel-less variety, *Reophax ampullacea*, Brady (*pars*) = *R. lenticularis*, Gryzb. 1895, *R. grandis*, Gryzb. 1897 and *R. placenta*, Gryzb. 1897.]

339. *Lagena marginata*, var. *fissa*, nov. Pl. V, figs. 24, 25.

Stations 27, 31.

This is an interesting variety in which the keel, rapidly increasing in breadth over the basal quadrant of the shell, is deflected just before reaching the aboral extremity and as rapidly decreases in breadth and vanishes, with the result that the extreme aboral end of the shell shows two keels somewhat widely separated. The figure will explain the structure.

Size:—Length, ·45 mm.; breadth ·40 mm.; thickness, ·22 mm.

340. *Lagena marginata*, var. *raricostata*, Sidebottom.

Lagena marginata, var. *raricostata*, Sidebottom, 1912, etc., LSP. 1912, p. 408, pl. xviii, figs. 8, 9.

Station 29.

A single typical specimen.

341. *Lagena marginata*, var. *semimarginata*, Reuss.

Lagena marginata, var. *semimarginata*, Reuss, 1870, FSP. p. 468; Schlicht, 1870, FSP. p. 11, pl. iv, figs. 4–6, 10–12.
,, ,, ,, ,, Brady, 1884, FC. p. 477, pl. lix, figs. 17–19.
,, ,, ,, ,, Millett, 1898, etc., FM. 1901, p. 619, pl. xiv, fig. 1.

Stations 11, 16, 19, 27.

Very rare but quite typical, the best at Station 19 in deep water, almost equally good at Station 11 (N.Z.).

342. *Lagena marginata*, var. *inaequilateralis*, Wright.

Lagena marginata, var. *inaequilateralis*, Wright, 1885–6, BLP. p. 321, pl. xxvi, fig. 10.
,, ,, ,, ,, Sidebottom, 1904, etc., RFD. 1906, p. 10, pl. ii, fig. 6.

Station 6.

Three typical specimens.

343. *Lagena unguis*, Heron-Allen and Earland.

Lagena unguis, Heron-Allen and Earland, 1913, CI. p. 86, pl. vii, figs. 1–3; 1913, FNS. p. 135; 1916, FSC. p. 46.

Station 2.

A single specimen, typical.

344. *Lagena marginato-perforata*, Seguenza. Pl. VI, figs. 8, 9.

Lagena marginato-perforata, Seguenza, 1879–80, FTR. p. 332, pl. xvii, fig. 34.
,, ,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 663, pl. L, figs. 24–30.

Stations 6, 10, 11, 27, 31.

Not infrequent in the N.Z. area, and very typical at Station 6. Less common, but typical, in the deep-water and Antarctic. At Station 10, the type is superseded by a large and striking variety characterized by a thick oral extremity with faint costal markings which die out over the surface of the shell but reappear at the base, where there is a raised semilunar ridge running concentrically with the basal edge. This form also occurs at Station 11, but is less strikingly developed, and is accompanied by the type.

345. *Lagena seminiformis*, Schwager.

Lagena seminiformis, Schwager, 1866, FKN. p. 208, pl. v, fig. 21.
,, ,, Brady, 1854, FC. p. 478, pl. lix, figs. 28–30.
,, *marginata*, var. *seminiformis*, Millett, 1898, etc., FM. 1901, p. 620, pl. xiv, fig. 3.

Station 6.

One rather weak specimen.

346. *Lagena lagenoides* (Williamson).

Entosolenia marginata, var. *lagenoides*, Williamson, 1858, RFGB. p. 11, pl. i, figs. 25, 26.
Lagena lagenoides, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 665.

Stations 5, 6, 10, 16, 17, 18.

Confined to the N.Z. area and deep water. Very rare but typical at Stations 5, 6 and 10. At Stations 16 and 18 specimens are very large and beautifully developed. At Station 16 a trigonal specimen, and a single individual of a very fine delicate type. At Station 17 all are small and delicate and pass imperceptibly into the var. *tenuistriata*. At this Station a single small specimen showing a raised ridge forming a horseshoe at the aboral end of the shell.

347. *Lagena lagenoides*, var. *tenuistriata*, Brady.

Lagena tubulifera, var. *tenuistriata*, Brady, 1879, etc., RRC. 1881, p. 61.
,, *lagenoides* ,, ,, Brady, 1884, FC. p. 479, pl. lx, figs. 11, 15, 16.
,, ,, ,, ,, Cushman, 1910, etc., FNP. 1913, p. 39, pl. xvi, fig. 3.

Stations 8, 10, 17, 22.

The distribution is similar to that of the type but it does not always occur at the same Stations. All the specimens are small, except at Stations 22 and 23, where they are large, but are otherwise dissimilar, the markings being very coarse at Station 22 and typically delicate at Station 23. At Station 10 a small trigonal specimen.

At Station 8 a few specimens exhibiting a lateral twist in the long axis of the shell, combined with a certain duplication and overlapping of the wing at the middle of the base, comparable with our *L. marginata*, var. *fissa* in its most extreme development. The specimens may be compared with Silvestri's figure of *Fissurina radiata*, Seg. (S. 1902, LMT. p. 145, figs. 20–22), but Silvestri's figure has little or no resemblance to Seguenza's original (S. 1862, FMMM. p. 70, pl. ii, figs. 42, 43) which represents *L. lagenoides* of a normal type. Much more closely allied to our specimens, and perhaps identical, is the form figured by Rymer Jones (J. 1872, LJS. p. 59, pl. xix, fig. 42) under the name *L. vulgaris*, sub-var. *spinoso-marginata*. His figure is drawn from a broken specimen, but the shading appears to indicate the twist of the shell and the duplication of the basal keel, although he makes no reference to either feature in the text.

348. *Lagena lagenoides*, var. *nuda*, Chapman.

Lagena lagenoides, var. *nuda*, Chapman, 1909, SNZ. p. 338, pl. xv, fig. 9.

Stations 16, 18, 20.

Excellent representative specimens from each Station. The shell-substance in all cases is white and opaque, but indicates no corrosion. The relationship to *L. lagenoides* does not appear to be very clear except as regards the general similarity of outline; we should have been inclined to regard it as more nearly allied to *L. bicarinata*. Some of the specimens are feebly pedunculate.

349. *Lagena ornata* (Williamson).

Entosolenia marginata, var. *ornata*, Williamson 1858 RFGB. p. 11, pl. i, fig. 24.
Lagena ornata, Heron-Allen and Earland, 1913, CI, p. 88, pl. vii, fig. 8.

Station 2.

A single coarse, thick-shelled specimen.

350. *Lagena formosa*, Schwager. Pl. VI, figs. 24, 25.

Lagena formosa, Schwager, 1866, FKN. p. 206, pl. iv, figs. 19, *a–d*, pl. vii, fig. 1.
,, ,, Millett, 1898, etc., FM. 1901, p. 624, pl. xiv, figs. 10–12.
,, ,, Sidebottom, 1912, etc., LSP. 1912, p. 414, pl. xix, figs. 6–9; 1913, p. 191, pl. xvii, figs. 3–8.

Stations 27, 36.

Very rare. Nearly all the specimens resemble the type figured by Sidebottom (1912, pl. xix, fig. 6), but at Station 27 there is a specimen (Pl. VI, figs. 24, 25), which probably represents his later figure (1913, pl. xvii, fig. 6) in the perfect condition. The neck is very long, nearly equal to the length of the shell, with an everted lip. The central area is marked, as in Sidebottom's figure, and here the shell-wall is apparently thickened. The tubules shown round the edge of Sidebottom's figure are not indicated in our specimen, but the whole of the thick marginal edge, which projects more than in Sidebottom's figure, is filled with dense, sponge-like shell-structure.

351. *Lagena formosa*, var. *comata*, Brady.

Lagena formosa, var. *comata*, Brady, 1884, FC. p. 480, pl. lx, fig. 22.
„ „ „ „ Cushman, 1910, etc., FNP. 1913, p. 42, pl. xi, fig. 8.

Stations 22, 23, 53.

Represented by many magnificent specimens at each Station, that from Station 53 being smaller than the deep-water specimens.

352. *Lagena formosa*, var. *favosa*, Brady.

Lagena formosa, var. *favosa*, Brady, 1884, FC. p. 480, pl. lx, fig. 21.
„ „ „ „ Cushman, 1910, etc., FNP. p. 41, pl. xi, fig. 7.

Station 16.

Represented by the oral portions only of what must have been very large and finely marked individuals, clearly identifiable by the characteristic markings of the wing.

353. *Lagena quadrangularis*, Brady.

Lagena quadrangularis, Brady, 1884, FC. p. 483, pl. cxiv, fig. 11.
„ „ Millett, 1898, etc., FM. 1901, p. 625, pl. xiv, fig. 17.

Stations 18, 36.

One specimen, characterized by extreme length and narrowness of the shell, which is acutely pointed at both ends, at Station 18, and several smaller ones of the same type at Station 36. The cross section of our specimens is a square with hollowed sides, instead of an oblong as in Brady's type.

354. *Lagena quinquelatera*, Brady.

Lagena quinquelatera, Brady, 1879, etc., RRC. 1881, p. 60 ; 1884, FG. p. 484, pl. lxi, figs. 15, 16.
„ „ Millett, 1898, etc., FM. 1901, p. 493, pl. viii, fig. 11.

Stations 18, 20, 22.

Excellent and typical specimens.

355. *Lagena rizzae* (Seguenza).

Fissurina rizzae, Seguenza, 1862, FMMM. p. 72, pl. ii, fig. 50.
Lagena „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 666.

Stations 2, 6.

Very rare.

356. *Lagena bicarinata* (Terquem).

Fissurina bicarinata, Terquem, 1882, FEP. p. 31, pl. i (ix), fig. 24.
Lagena „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 665.

Stations 2, 3, 6, 9, 11, 16, 18, 22, 23, 27, 29, 36.

Widely but sparingly distributed, presenting a great range within its specific character. The best at Stations 6, 11, 22, 23. At Station 3 a very long type with parallel sides occurs.

At Station 2 a remarkable specimen was found, heart-shaped, with an entosolenian aperture at each extremity. The surfaces plane, slightly sloping from the thickest extremity or point of the heart to the base. The principal aperture appears to be at the pointed end.

357. *Lagena bicarinata*, var. *villosa*, nov. Pl. VI., figs. 10–12.

Stations 2, 3, 6.

Characters similar to the type, but the marginal edges are thickened with shell-substance, granular in structure, giving the appearance of a fur trimming round a clear test. Confined to the N.Z. area and rare. The best specimens at Station 6.

Size :—Length, ·23 mm.; breadth, ·20 mm.; thickness, ·12 mm.

358. *Lagena bicarinata*, var. *spinigera*, nov. Pl. VI, figs. 6, 7.

Lagena bicarinata, Sidebottom, 1912, etc., LSP. 1912, p. 419, pl. xix, fig. 27.

Stations 17, 23.

One specimen at each Station referable to Sidebottom's form as referred to above, characterized by the weakly developed and widely separated carinae and the presence of a single conspicuous basal spine, to which no reference is made in his text, though it is clearly indicated in the drawing. The spine in our specimens are very much more developed than is shown in his figure.

Size :—Total length, ·27 mm. (including spine, ·03 mm.); breadth, ·09 mm.

359. *Lagena enderbiensis*, Chapman.

Lagena enderbiensis, Chapman, 1909, SNZ. p. 339, pl. xvi, figs. 1, *a*, *b*.

Stations 2, 6.

Fairly frequent. This appears to be one of the typical N.Z. Foraminifera.

360. *Lagena orbignyana* (Seguenza.)

Fissurina orbignyana, Seguenza, 1862, FMMM. p. 66, pl. ii, figs. 25, 26.
Lagena ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 666.

Stations 2, 3, 5–8, 10, 11, 16–18, 22, 27, 36, 45, 48.

Universally distributed, most frequent in the N.Z. area, where two distinct types occur at most of the Stations, one being much longer than the other, and usually with poorly developed keels, forming a variety intermediate between Chapman's *L. enderbyensis* and the type. At Station 6 in the N.Z. area specimens occur of a quadrate circular type, with spinous base, referable to Millett's variety, *calcar* (M., 1885, etc., St. E. 1898, p. 175, pl. 0), but differing from his specimens in the absence of the produced neck, as figured in the original drawing, and in the more quadrate outline of the test, as figured in his Malay paper (M., 1898, etc., F.M. 1901, p. 626, pl. xiv, fig. 18), and figured by Sidebottom, without a varietal name, from the Pacific (S., 1912, etc., LSP., 1912, p. 416, pl. xix, fig. 14). The finest development is attained in the deep-water Stations, notably Stations 16–18, where

they are large, often furnished with very wide median carinæ, and at Stations 17 and 18, passing imperceptibly into var. *coronata*, Sidebottom. Excellent examples with wide carinae occur as far south as Stations 45 and 48.

361. *Lagena orbignyana*, var. *selseyensis*, Heron-Allen and Earland.

Lagena orbignyana, var. *selseyensis*, Heron-Allen and Earland, 1908, etc., SB. 1909, p. 426, pl. xvii, figs. 1, 2.
„ „ „ „ Halkyard, 1919, BMB. p. 63.

Stations 3, 6.

The elongate type referred to in our note on *L. orbignyana* reaches its final development in specimens occurring at these Stations, and referable to our variety *ut supra*.

362. *Lagena orbignyana*, var. *walleriana*, Wright.

Lagena orbignyana, var. *walleriana*, Wright, 1886, SWI. p. 611; and 1891, SWI. p. 481, pl. xx, fig. 8.
„ „ „ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 666, pl. L, figs. 31–36.

Stations 3, 6, 7, 32.

Very rare, single individuals only at each Station. Excellent at Stations 7 and 32.

363. *Lagena orbignyana*, var. *baccata*, nov. Pl. VI, figs. 15, 16.

Stations 4, 5, 6, 8.

Test circular in outline, consisting of a circular chamber with short produced neck, flush with the extremity of which the median carina extends without variation in width right round the shell. The superior and inferior faces of the chamber are either parallel or but slightly convex, and its edge is furnished with a thickened margin forming the outer carina of the test, this carina being broken up at regular intervals all round by constrictions which give a beaded outline to a complete ring concentric with the centre of the test.

Dimensions:—·20 mm. in diameter; ·07 mm. in thickness.

This very characteristic and pretty little form is confined to the N.Z. area, where it occurs sparingly at the Stations.

364. *Lagena orbignyana*, var. *concentrica*, Sidebottom.

Lagena orbignyana, var. *concentrica*, Sidebottom, 1912, etc., LSP. 1912, p. 417, pl. xix, fig. 23.
„ „ „ „ Cushman, 1910, etc., FNP. 1913, p. 44, pl. xix, fig. 2.

Station 36.

A few good specimens. The median carina is wider and better developed than in Sidebottom's figure.

365. *Lagena orbignyana*, var. *coronata*, Sidebottom.

Lagena orbignyana, var. *coronata*, Sidebottom, 1912, etc., LSP. 1912, p. 416, pl. xix, fig. 15.
,, ,, ,, ,, *Cushman, 1910, etc., FNP. 1913, p. 43, pl. xx, fig. 3.

Stations 16, 17, 36.

Confined to deep-water Stations. Frequent and typical at Station 16. At Station 36 the variety is represented by a single very fine individual, in which the carinae are interrupted in the middle of the base, and replaced by a tuft of fine spines.

366. *Lagena orbignyana*, var. *unicostata*, Sidebottom.

Lagena orbignyana, var. *unicostata*, Sidebottom, 1912, etc., LSP. 1912, p. 417, pl. xix, fig. 22.

Stations 17, 29.

A number of specimens with very variable minor features can, perhaps, be best referred to this variety. The basal notch in the carina indicated in Sidebottom's figure is generally extremely strong; in fact, all three keels are thus cut away in some specimens at the actual base of the shell. The central costa which gives it the varietal name is represented in different specimens by one, two, or three bars. Occasionally it is reduced almost to the clear bead of var. *walleriana*, indicating a transition stage between many forms of the *orbignyana* type.

367. *Lagena orbignyana*, var. *yokoyamae*, Millett. Pl. VI, figs. 17, 18.

Lagena yokoyamae, Millett, 1885, etc., St. E. 1894, p. 657 (no fig.).

Stations 1–3, 6.

Differing from the normal *L. orbignyana* in the thick, ill-developed median carina, in the development on the surfaces of the shell, of a series of ridges extending from the margin of the clear convex faces to the inner surface of the raised outer carinae. The marginal fringe of the chamber is by this means cut up into a series of radiating depressed chamberlets, which, in the majority of specimens, take the form of sunken pits separated by narrow high ridges. At Station 3, however, a number of specimens show these radial chamberlets to be covered with a superficial enclosing wall continuous with the outer test of the chamber, so that each becomes a sealed cavity, and this may be, possibly is, the normal type, the enclosing surface-membrane being sufficiently thin to become easily absorbed or destroyed during the life-time of the animal, and so forming the sunken "trenches" or pits.

Dimensions:—Length, ·30–·35 mm.; breadth, ·22–·23 mm.

This very striking form is confined to the N.Z. area, where it is comparatively frequent at Stations 2 and 3.

These specimens appear to be closely allied to, if not identical with, the

form referred to by Millett in his third St. Erth paper (*ut supra*). He then expressed the intention of describing and figuring it under the specific name *L. yokoyamae* in a forthcoming paper on the Foraminifera of the shore-sands of Misaki, Japan. Millett's collection of specimens and papers passed into our hands on his death. We have been unable to locate any specimens, and the notes are of a fragmentary nature, that on this variety being merely the paragraph published in the St. Erth paper (*ut supra*). But there is a drawing of the species among his papers which identifies it with our N.Z. specimens, to which we give Millett's specific name, reducing it to a varietal form of *L. orbignyana*.

368. *Lagena scarabaeus*, sp. nov. Pl. VI, figs. 20–23.

Stations 2, 3, 5, 6.

Test oblong with rounded off corners; entosolenian. Median carina but slightly developed. The two faces of the test, which are flattened and approximately parallel, are marked by a series of concentric ridges conforming to the outline of the test. The number of these ridges varies, but in the best-marked individuals there are three or more confocal rings, fairly widely separated, the inner ring being divided in its long axis by a raised bar. In other specimens, although the number of rings is no greater, they are set much closer together so as to present a considerable central space which, instead of having the transverse bar, is more or less roughly granular with upstanding shell-substance.

Dimensions:—Length, ·30–·45 mm.; breadth, ·22–·30 mm.; thickness, ·12 mm.

Confined to the N.Z. area and comparatively common at the Stations. The best series from Station 5. The species is very distinctive, and is remarkably suggestive of an Egyptian Scarab. The general appearance is very like Sidebottom's figure of his var. *L. auriculata*, var. *clypeata* (S. 1912, etc., LSP. 1913, p. 199, pl. xviii, fig. 5) but none of the N.Z. specimens exhibits any trace of the basal loops distinguishing *L. auriculata*.

Nearly all the specimens are fossils.

369. *Lagena lacunata*, Burrows and Holland.

Lagena castrensis, Brady (*non* Schwager), Brady, 1884, FC. p. 485, pl. lx, figs. 1, 2 and (?) 3
„ *lacunata*, Heron-Allen and Earland, 1916, etc., FKA. 1915, p. 668.

Stations 5, 6.

Very few typical specimens. In the majority of cases the lacunæ in the shell-wall are represented by opaque inclusions of a milky-white shell-substance contrasting with the hyaline surface of the test.

370. *Lagena castrensis*, Schwager.

Lagena castrensis, Schwager, 1866, FKN. p. 208, pl. v, fig. 22.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 667.

Stations, 2, 6, 10.

A few specimens only from the N.Z. area, the best from Station 6.

371. *Lagena pulchella*, Brady.

Lagena pulchella, Brady, 1866, Rep. Brit. Ass. (1867), p. 70.
„ „ Brady, 1870, FTR. p. 294, pl. xii, fig. 1, *a*, *b*.
„ „ Balkwill and Wright, 1885, DIS. p. 342, pl. xii, fig. 19.

Stations 2, 3, 6.

Like *L. clathrata*, from which it differs by its branching costae, this form is confined to the N.Z. area, where it is rare. The best specimens at Station 6.

372. *Lagena pulchella*, var. *hexagona*, Heron-Allen and Earland.

Lagena pulchella, var. *hexagona*, Heron-Allen and Earland, 1916, FWS. p. 254, pl. xli, fig. 27.

Station 6.

At this Station several specimens of this very ornate variety.

373. *Lagena clathrata*, Brady.

Lagena clathrata, Brady, 1884, FC. p. 485, pl. lx, fig. 4.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 668.

Stations 2, 3, 5–8, 10–12, 36.

This is one of the most characteristic N.Z. Foraminifera, and, with the exception of a single specimen, all our records are confined to that area. It is, moreover, very variable, the lines of variation developing in the direction of the suppression of the keel, and the number of costae on the faces of the test. Individuals with weak development of the keel have as a rule an excessive number of costae on the face of the shell, while those with a strongly-developed median carina are usually furnished with a very limited number of strong costae. Specimens of this type have been noticed with as few as three prominent costae, and the number rarely exceeds seven when the costae are strong. At Station 5 a specimen with a long produced neck, the only one found in N.Z., and closely resembling the only specimen recorded outside the N.Z. area, which was from Station 36 (2,216 fms.), the surface of which is very finely costate. The best N.Z. Stations are Stations 6, 7, and 10.

374. *Lagena clypeato-marginata*, var. *crassa*, Sidebottom.

Lagena vulgaris, var. *clypeato-marginata*, Rymer Jones, 1872, LJS. p. 58, pl. xix, fig. 37.
„ *clypeato-marginata*, Sidebottom, 1912, etc., LSP. 1912, p. 425, pl. xxi, fig. 6.

Stations 10, 11.

Moderately abundant at both Stations. Many of the specimens agree entirely with Sidebottom's description and figure, in others the markings, which he says "are sometimes arranged as lines," have developed into feeble costae. The species is referable to the *L. auriculata* group, some of the specimens showing well-developed loops at the basal edges.

375. *Lagena danica*, Madsen.

Lagena danica, Madsen, 1895, FDH. p. 196, pl. 0, fig. 4.
„ „ Goës, 1896, DOA. p. 53, pl. v, figs. 11, 12.

Stations 6, 8, 17, 18.

Very good and typical specimens from deep water Stations 17, 18; less distinctive from Stations 6 and 8 in the N.Z. area.

376. *Lagena danica*, var. *pendulum*, nov. Pl. VI, figs. 13, 14.

Stations 10, 11.

Differs from the type by the presence of a comparatively long neck joined to the body of the shell by a broad wing. The body of the test increases in thickness towards the aboral extremity. At the widest point in its diameter, the carina starting from the neck divides into a thickened rim, surrounding a wide area at the base of the shell as in the type. The shape suggests the "bob" of a pendulum. Not uncommon at the Stations where it occurs, but at these Stations the type is absent.

Size:—Length, ·30–·35 mm.; breadth, ·20 mm.; maximum thickness, ·18 mm.; thickness at base, ·10 mm.

377. *Lagena fimbriata*, Brady.

Lagena fimbriata, Brady, 1879, etc., RRC. 1881, p. 61; 1884, FC. p. 486, pl. lx, figs. 26–28.
„ *orbignyana*,? Sidebottom, 1912, etc., LSP. 1912, p. 418, pl. xxi, fig. 15.

Stations 10, 16, 27, 36.

Singularly rare, represented as a rule by one specimen at each Station. At Station 27 were two large typical individuals. At Station 36 a number of exceedingly delicate spines protrude from the enclosed basal portion.

378. *Lagena fimbriata*, var. *occlusa*, Sidebottom.

Lagena fimbriata, var. *occlusa*, Sidebottom, 1912, etc., LSP. 1912, p. 423, pl. xx, figs. 27, 28; 1913, p. 202.
„ „ „ „ Heron-Allen and Earland, 1913, CI. p. 90, pl. vii, fig. 15.

Stations 15, 18.

A single specimen at each Station.

379. *Lagena auriculata*, Brady. Pl. VI, fig. 26.

Lagena auriculata, Brady, 1879, etc., RRC. 1881, p. 61; 1884, FC. p. 487, pl. lx, figs. 29, etc.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 669.

Stations 9, 10, 11, 16, 17, 26 (+ K. I.).

Confined to N.Z. and deep water, and the specimens are, as a rule, small, but distinctive. At Station 9 a single individual (·16 mm. long), marked by the pressure of distinct tubular loops at the four corners of a somewhat quadrate

test. The aperture appears to occupy the whole of the space between the oral loops.

380. *Lagena auriculata*, var. *quadri-auriculata*, nov. Pl. VI, fig. 27.

Station 16.

A single specimen, resembling Sidebottom's figure (LSP. 1912, etc., 1912, p. 422, pl. xx, fig. 21) of var. *costata*, except for the fact that there are two separate pairs of loops on each side of the base, connected by the extended wing. This clearly proves that it is more closely related to *L. auriculata* (characterized by two loops only) than to *L. alveolata*, which normally has four loops divided into two pairs by a keel. At the upper edge of the shell, below the base of the neck, a pair of tubules similar to the basal tubes also occurs.

Size :—Length (without neck), ·18 mm. ; maximum breadth, ·12 mm.

381. *Lagena alveolata*, Brady.

Stations 16, 18, 20, 22, 23, 36 (+ T. d. F.).

Lagena alveolata, Brady, 1884, FC. p. 487, pl. lx, figs. 30, 32.
„ „ Cushman, 1910, etc., FNP. 1913, p. 33, pl. xviii, fig. 1.

Confined to deep-water Stations. Very good and typical at Stations 20 and 36.

382. *Lagena alveolata*, var. *substriata*, Brady.

Lagena alveolata, var. *substriata*, Brady, 1879, etc., RRC. 1881, p. 61; 1884, FC. p. 488, pl. lx, fig. 34.
„ „ „ „ Cushman, 1910, etc., FNP. 1913, p. 34, pl. xviii, fig, 5.

Stations 18, 19, 20, 22 (+ T. d. F.).

Similar distribution. The best at Station 18.

Sub-Family NODOSARIINAE.

NODOSARIA, Lamarck.

383. *Nodosaria rotundata* (Reuss).

Glandulina rotundata, Reuss, 1849–50, FOT. p. 366, pl. xlvi (i), fig. 2.
Nodosaria (*G.*) *rotundata*, Brady, 1884, FC. p. 491, pl. lxi, figs. 17–19.

Stations 2, 3, 11, 38.

Very good specimens at Stations 2 and 38 ; poor at the others.

384. *Nodosaria laevigata*, d'Orbigny.

Nodosaria (*G.*) *laevigata*, d'Orbigny, 1826, TMC. p. 252, no. 1, pl. x, figs. 1–3.
„ „ Brady, 1884, FC. pp. 490, 493, pl. lxi, figs. 17–22, 32.
„ „ Millett, 1898, etc., FM. 1902, p. 509, pl. xi, fig. 1.

Stations 2, 6, 16, 27, 31, 54, 55.

Occurs in all the areas, rare, but large and typical. Exceptionally good at Stations 2 and 54.

385. *Nodosaria radicula* (Linné).

Nautilus radicula, Linné, 1767, etc., SN. Ed. xii, p. 1,164.
Nodosaria ,, Brady, 1884, FC. p. 495, pl. lxi, figs. 28–31.
,, ,, Millett, 1898, etc., FM. 1902, p. 513.

Stations 2, 6, 10 11.

Confined to the N.Z. area and inconspicuous, except at Station 6, where very fine examples of both the megalo- and micro-spheric forms occur.

386. *Nodosaria simplex*, Silvestri.

Nodosaria simplex, Silvestri, 1872, NFVI. p. 95, pl. xi, figs. 268–272.
,, ,, Heron-Allen and Earland, 1913, CI. p. 91, pl. viii, fig. 1.

Stations 6, 7.

Good typical specimens.

387. *Nodosaria calomorpha*, Reuss.

Nodosaria calomorpha, Reuss, 1865–6, FABS. p. 129, pl. i, figs. 15–19.
,, ,, Millett, 1898, etc., FM. 1902, p. 513.

Stations 6, 10, 17, 18, 27, 31, 36 (+ D.).

Generally distributed, but as a rule feebly developed, the number of chambers seldom exceeding three. At Station 18, however, one large and typical individual with five chambers occurs.

[Arenaceous isomorph, *Reophax membranacea*, Brady.]

388. *Nodosaria pyrula*, d'Orbigny.

Nodosaria pyrula, d'Orbigny, 1826, TMC. p. 253, no. 13.
,, ,, Brady, 1884, FC. p. 497, pl. lxii, figs. 10–12.

Stations 6, 7, 10, 11.

Recognizable fragments only, except at Station 6, where many large specimens (as usual, broken) occur. Several of these show the long-pointed primordial chamber typical of the species, and from their length must, when perfect, have attained a size of at least half an inch.

[Arenaceous isomorphs, *Reophax guttifera*, Brady, and *Hormosina ovicula*, Brady.]

389. *Nodosaria farcimen* (Soldani).

Orthoceras farcimen, Soldani, 1791, Testaceographia, vol. i, pt. 2, p. 98, pl. 105, fig. 0.
Nodosaria ,, Brady, 1884, FC. p. 498, pl. lxii, figs. 17, 18; and p. 499, figs. 13, *a–c*.
,, ,, Millett, 1898, etc., FM. 1902, p. 523.

Stations 3, 9, 11.

The only really good specimen, recent but broken, at Station 11. At Stations 3 and 9 less typical examples.

[Arenaceous isomorph, *Reophax nodulosa*, Brady.]

390. *Nodosaria soluta* (Reuss).

Dentalina soluta, Reuss, 1851, FSUB. p. 60, pl. iii, fig. 4.
Nodosaria ,, Brady, 1884, FC. p. 503, pl. lxii, figs. 13–16; pl. lxiv, fig. 28.

Stations 6, 7, 16.

Typical fragments from Stations 7 and 16, and at Station 6 a perfect specimen intermediate between this species and *L. subtertenuata*.

[Arenaceous isomorphs, *Reophax pilulifera* and *spiculifera*, Brady.]

391. *Nodosaria gracilis*, Neugeboren.

Nodosaria gracilis, Neugeboren, 1850, etc., FOL. 1852, p. 51, pl. i, figs. 27–29.

Station 6.

One large fragment, consisting of three chambers only, but measuring 4 mm., which we have no hesitation in attributing to this extremely elongated type of *N. filiformis*. As Neugeboren's name had been anticipated for a different form by d'Orbigny we might have ascribed this specimen to *N. filiformis*, d'Orb.

392. *Nodosaria filiformis*, d'Orbigny.

Nodosaria filiformis, d'Orbigny, 1826, TMC. p. 253, no. 14.
,, ,, Cushman, 1910, etc., FNP. 1913, p. 55, pl. xxvii, figs. 1–4.

Stations 6–8, 10, 16.

Confined to the N.Z. area and the deep water to the immediate south. Nothing noteworthy about the specimens except at Station 6, where recent specimens attain a remarkable size. At the same Station fossil remains occur of very much smaller dimensions. This would appear to show a change of conditions at the locality in the intervening period.

[Arenaceous isomorph, *Reophax spiculifera*, Brady.]

393. *Nodosaria communis*, d'Orbigny.

Nodosaria (*Dentalina*) *communis*, d'Orbigny, 1826, TMC. p. 254, no. 35.
,, *communis*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 670.

Stations 3–6, 8, 10, 11, 17, 18, 38 (+ R. d. J.).

Generally distributed down to Station 38. Best in the N.Z. area, where very fine and large examples occur at Stations 5 and 6. Outside this area best at Station 18. At Stations 10 and 11, where the type is small and inconspicuous, a compressed vaginuline variety occurs and is rather better developed. They closely resembled the specimens described and figured by us from the West of Scotland. H.-A. & E. 1916, FWS. p. 256, pl. xlii, figs. 1, 2.

[Arenaceous isomorph, *Reophax spiculifera*, Brady.]

394. *Nodosaria mucronata* (Neugeboren).

Dentalina mucronata, Neugeboren, 1856, OLS. p. 83, pl. iii, figs. 8–11.
Nodosaria „ Cushman, 1910, etc., FNP. 1913, p. 56, pl. xxiv, fig. 3; pl. xxv, fig. 2; pl. xxvii, figs. 5–7; pl. xxxv, fig. 6.

Stations 6, 16, 36.

Fine and typical specimens at Station 6, smaller at the others.

395. *Nodosaria roemeri* (Neugeboren).

Dentalina roemeri, Neugeboren, 1856, OLS. p. 82, pl. ii, figs. 13–17.
Nodosaria (*D.*) *roemeri*, Cushman, 1910, etc., FNP. 1913, p. 55, pl. xxiv, figs. 4–6.

Stations 6, 10.

Very rare; best at Station 6.

396. *Nodosaria consobrina*, d'Orbigny.

Nodosaria (*D.*) *consobrina*, d'Orbigny, 1846, FFV. p. 46, pl. ii, figs. 1–3.
„ „ Brady 1884, FC. p. 501, pl. lxii, figs. 23, 24.
„ „ Halkyard, 1919, BMB. p. 67, pl. iv, fig. 7.

Station 6.

Large and typical.

397. *Nodosaria consobrina*, var. *emaciata*, Reuss.

Dentalina emaciata, Reuss, 1851, FSUB. p. 63, pl. iii, fig. 9.
Nodosaria consobrina, var. *emaciata*, Cushman, 1910, etc., FNP. 1913, p. 56, pl. xxvii, fig. 9.

Station 6.

Magnificent specimens.

398. *Nodosaria pauperata* (d'Orbigny).

Dentalina pauperata, d'Orbigny, 1846, FFV. p. 46, pl. i, figs. 57, 58.
Nodosaria „ Cushman, 1910, etc. FNP. 1913, p. 51, pl. xxv, fig. 7.

Stations 1–3, 5–8, 10, 12, 16, 54.

Frequent in the N.Z. area, and also occurs in two deep-water Stations to the immediate south. Not recorded beyond this point till we reach the extreme south, at Station 54, where a single very large example was found, spinous at the base. The N.Z. specimens attain very fine dimensions at Stations 1 and 2 (recent). At the other N.Z. Stations the individuals are mostly small—both fossil and recent. At Station 2 an abnormal recent specimen in which the chambers are arranged in a zig-zag line.

[Arenaceous isomorph, *Reophax bacillaris*, Brady.]

399. *Nodosaria subtertenuata*, Schwager.

Nodosaria subtertenuata, Schwager, 1866, FKN. p. 235, pl. vi, fig. 74.
„ „ Brady, 1884, FC. p. 507, pl. lxii, figs. 7, 8.

Station 6.

Good specimens, both recent and fossil.

400. *Nodosaria hispida*, d'Orbigny.

Nodosaria hispida, d'Orbigny, 1846, FFV. p. 35, pl. i, figs. 24, 25.
,, *hirsuta*, Cushman, 1910, etc., FNP. 1913, p. 60, pl. xxviii, fig. 3.

Stations 6, 7, 10, 11 (+ R. d. J.).

Confined to the N.Z. area, and all recent specimens. Frequent, and attaining very fine dimensions at Station 6, as many as five separate chambers, separated by long stolon tubes. Smaller and less developed at the other Stations.

At Station 7 the species is represented by the comparatively smooth nodosarian type without separate stolon tubes, of which Schwager's *N. setosa* may be taken as an example (S. 1866, FKN. p. 218, pl. xv, fig. 40).

[Arenaceous isomorph, *Reophax polyeides*, Deecke (1884, Abh. geol. Sp. K. Elsass Loth. vol. iv, p. 19, pl. i, fig. 2, and 1886, Mém. Soc. Émul. Montbeliard, vol. xvi, p. 14 (reprint) pl. ii, fig. 20A).]

401. *Nodosaria comata* (Batsch).

Nautilus (*Orthoceras*) *comatus*, Batsch, 1791, CS. p. 2, pl. i, fig. 2.
Nodosaria comata, Brady, 1884, FC. p. 509, pl. lxiv, figs. 1–5.
,, ,, Millett, 1898, etc., FM. 1902, p. 512, pl. xi, fig. 2.

Stations 3, 6.

One specimen at each Station, neither very typical.

402. *Nodosaria scalaris* (Batsch).

Nautilus (*Orthoceras*) *scalaris*, Batsch, 1791, CS. p. 2, pl. ii, fig. 4.
Nodosaria scalaris, Cushman, 1910, etc., FNP. 1913, p. 58, pl. xxiv, fig. 7.

Stations 3, 6, 10, 11 (+ R. d. J.).

Confined to the N.Z. area. There is the usual range of variation in the character of the markings, but coarsely sulcate specimens predominate, the best at Station 3. At Stations 10 and 11 the tendency is to fine striation, the markings practically disappearing in some of the latter specimens.

403. *Nodosaria raphanistrum* (Linné).

Nautilus raphanistrum, Linné, 1767, etc., SN. 1788, p. 3,372.
Nodosaria ,, Jones, Parker and Brady, 1866, etc., MFC. 1866, p. 50, pl. i, figs. 6–8.

Stations 1, 23, 27, 36.

Very rare and very small, except at Station 1, where a bilocular specimen of a large size was found.

404. *Nodosaria obliqua* (Linné).

Nautilus obliquus, Linné, 1767, SN. p. 1,163, no. 281 ; 1788, SN. p. 3,372, no. 14.
Nodosaria obliqua, Cushman, 1910, etc., FNP. 1913, p. 59, pl. xxv, fig. 5.

Stations 6, 16 (+ D.).

Very fine specimens at Station 6, the largest 8 mm. in length. One of

these large examples is characterized by the formation of a very thin terminal chamber less than half the size of the penultimate chamber, evidence of senility or of a moribund condition. At Station 16 a recognizable fragment only.

405. *Nodosaria vertebralis* (Batsch).

Nautilus (*Orthoceras*) *vertebralis*, Batsch, 1791, CS. p. 3, No. 6, pl. ii, figs. 6, *a*, *b*.
Nodosaria vertebralis, Cushman, 1910, etc., FNP. 1913, p. 60, pl. xxxii, fig. 1.

Station 6.

Excellent and typical examples at Station 6. Also one very large specimen ($5\frac{1}{2}$ mm.) in which the longitudinal costae, which begin strong and normal, gradually die away in later chambers, becoming smooth and sub-globular until, towards the oral extremity, the costae are mostly represented by weak bridges across the sunken sutural lines.

406. *Nodosaria catenulata*, Brady.

Nodosaria catenulata, Brady, 1884, FC. p. 515, pl. lxiii, figs. 32–34.
„ „ Cushman, 1910, etc., FNP. 1913, p. 57, pl. xxv, fig. 3.

Station 11.

Two very weak but clearly identifiable specimens.

407. *Nodosaria adolphina* (d'Orbigny).

Dentalina adolphina, d'Orbigny, 1846, FFV. p. 51, pl. ii, figs. 18–20.
Nodosaria „ Schwager, 1866, FKN. p. 235, pl. vi, figs. 72, 73.
„ *monilis*, O. Silvestri, 1872, NFVI, p. 71, pl. viii, fig. 173–189.

Stations 2, 3, 6, 7.

Limited to the N.Z. area, and all the specimens have a more or less eroded surface; probably some are of recent origin, but others are derived from beds of submarine fossil origin (See Introductory Note, p. 27). Except at Station 7, where the microspheric type occurs, the specimens being small and prominently spinous, all the specimens are megalospheric and the spinous development is scant. The best and largest are from Station 6.

D'Orbigny's species represent a well marked type, subject to great variation in the number of spines and the method of their arrangement in one or more bands round the base of the chambers. Many species have been created on the strength of these minor variations. O. Silvestri (*ut supra*) proposed to abandon d'Orbigny's specific name in favour of the name given to certain figures by Soldani, but his reasons appear to be entirely insufficient (Soldani, Testaceographia, 1789, etc., 1798, vol. ii, p. 15, pl. ii, fig. N, *Orthoceras arthrocena sive globulifera*; vol. ii, p. 35, pl. x, fig. *a*, *Orthoceras monile*; see P. & J., etc., 1859, etc., NF. 1871, p. 155, pl. ix, fig. 37). The Soldanian figures represent a smooth moniliform test, and have been identified by Brady, Parker and Jones, and others,

with d'Orbigny's *Nodosaria pyrula*, and we have no hesitation in accepting this identification.

408. *Nodosaria pellita*, sp. nov. Pl. VI, figs. 28, 29.

Station 11.

Test consisting of two chambers only, furnished with a produced neck covered with thickened bands. Basal chamber bearing in some cases a short spine. The shell-wall consists of two layers, an inner vitreous layer covered with exceedingly fine papillae, which are usually broken off, giving a granular appearance to the clear shell-substance. The outer layer consists of dense, opaque, somewhat glistening shell-substance, covering the whole of the shell and extending on to the neck. The shell, when perfect, is of a glistening white appearance owing to this external layer, which is evidently of a very fragile nature, as in many specimens it is denuded in parts, leaving the delicate hyaline inner shell unbroken.

Dimensions :—Length, ·40–·45 mm. ; breadth, ·15 mm.

Confined to Station 11, where several individuals were found, in all stages of denudation.

LINGULINA, d'Orbigny.

409. *Lingulina carinata*, d'Orbigny.

Lingulina carinata, d'Orbigny, 1826, TMC. p. 257, no. 1, Modèle no. 26.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 670.

Stations 1, 2, 6.

A single exceptionally large and fine specimen at each. And at Station 6, two specimens much smaller in size and with rounded edges, comparable with *L. dentaliniformis*, Terquem (T., 1869, etc., FOM., 1870, p. 339 (p. 237 in the reprints) pl. xxv, figs, 1–3 ; pl. xxiii, figs. 1–7). The extent and development of the keel in this species has led to the creation of a large number of species. D'Orbigny's species is found primarily on a figure of Soldani (Testaceographia, 1798, vol. ii, p. 37, pl. xii, fig. P, etc.), which shows no trace of carination. D'Orbigny's figure (1839, FIC. pl. i, figs. 5, 6) also gives no indication of a sharp edge, but the "Modèle" (*ut supra*) has a sharp edge probably indicating a keel, and is in other respects identical with the type specimen in Paris, which we have examined. We do not attribute much, if any, importance to the carination, which, even in the most extreme examples of the species, only represents the difference between a rounded and a sharp edge, and every intermediate stage between these two may be observed in any extended series of specimens. Still less can we agree with Cushman in forming a new species, *L. grandis*, on the score of size only (C., 1917, NFP. p. 656 ; and 1919, RFNZ. p. 614). *L. carinata* is one of these species which vary enormously in size.

At Station 2, the large specimen shows spiral arrangement of the early portion of the shell and is referable, under extreme taxonomical stress, to *Lingulinopsis carlofortensis*, Bornemann (B., 1883, L. p. 26, pl. vi). As we have already indicated elsewhere (H., 1919, BMB. p. 81), we regard the subgenus *Lingulinopsis* as unworthy of retention, and we record this specimen merely as a biological variation from the type.

410. *Lingulina biloculi*, Wright.

Lingulina carinata, var. *biloculi*, Wright, 1910–11, ECM. p. 13, pl. ii, fig. 10.
,, *biloculi*, Heron-Allen and Earland, 1913, CI. p. 94, pl. viii, figs. 5–7.

Station 55.

A single typical example from the southernmost Station. This species has only been recorded hitherto from the West of Ireland, Scotland (several "Goldseeker" dredgings), and the Estuarine Clays of Magheramorne.

FRONDICULARIA, Defrance.

411. *Frondicularia spathulata*, Brady.

Frondicularia spathulata, Brady, 1879, etc., RRC. 1879, p. 270, pl. viii, fig. 5.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 671.

Stations 2, 6, 27, 31.

Very rare, recent in the N.Z. area at Station 2, fossil at Station 6, very small but typical examples at Station 31.

412. *Frondicularia pygmaea*, Sidebottom. Pl. VI, fig. 33.

Frondicularia pygmaea, Sidebottom, 1904, etc., RFD. 1907, p. 5, pl. i, fig. 27.
,, ,, Heron-Allen and Earland, 1913, CI. p. 96, pl. viii, fig. 14.

Station 27.

A single specimen which, to obviate the erection of a new species on such insufficient evidence, we attribute to Sidebottom's species, although it is not in strict agreement with that, or with *F. denticulo-carinata*, Chapman, another species to which it bears some features of resemblance (C., 1891, etc., GF. 1894, p. 155, pl. iii, fig. 4). The specimen is perfect, ·31 mm. long, hyaline, consisting of four chambers only, exhibiting little increase in size. The primordial chamber is carinate. The second is carinate in the lower portion and furnished with projecting recurved hooks which extend from the limbate marginal edge of the chamber. In the third and fourth chambers, although the marginal edges are limbate and projecting, they do not form hooks. The sutural lines are depressed and only slightly curved, and the specimen might be referred to either *Lingulina* or *Frondicularia*.

413. *Frondicularia inaequalis*, Costa.

Frondicularia inaequalis, Costa, 1855, FMMV. p. 372, pl. iii, fig. 3.
,, ,, Brady, 1884, FC. p. 521, pl. lxvi, figs. 8–12.
,, ,, Heron-Allen and Earland, 1908, etc., SB. 1909, p. 427 ; 1910, pl. vii, fig. 13.

Station 11.

A broken but recognizable specimen.

414. *Frondicularia annularis*, d'Orbigny.

Frondicularia annularis, d'Orbigny, 1846, FFV. p. 59, pl. ii, figs. 44–47.
,, ,, Bütschli, 1880, in Bronn's Klassen und Ordnungen, p. 198, pl. viii, fig. 15.

Station 6.

A single large recent specimen, presenting characters intermediate between *F. annularis*, d'Orb., and *F. reussi*, Karrer (K., 1861, FWB. p. 441, pl. i, fig. 1). The first six chambers are coarsely sulcate, the seventh faintly so, the eighth and subsequent chambers devoid of markings.

415. *Frondicularia scottii*, sp. nov. Pl. VI, figs. 30–32.

Station 2.

Test free, tongue-shaped, flattened, and with thick edges. Scored longitudinally with deep irregular grooves. Shell-wall very thick and massive, giving an opaque appearance to the shell and concealing all segmentation. When wetted the chambers are seen to be saddle-shaped, the whole of the space between the overlapping edges of the chamber-cavities being filled in with solid shell-matter through which broad tubules extend to the surface of the shell on the marginal edge. Number of chambers, up to nine.

Dimensions :—Length, ·95–1·0 mm. ; breadth, ·40 mm. ; thickness ·10 mm.

This is an altogether abnormal form and does not appear to be very nearly allied to any described species. The massive character of the shell-wall, enclosing and masking all segmentation, is a most distinguishing feature.

The presence of a single specimen of *F. scottii* in our collection from "Challenger" Station 185, off Raine Id., Torres Straits, 155 fms. possibly indicates a wide area of distribution for this species. The "Challenger" specimen is smaller and poorly developed, but its identity is unquestionable.

RHABDOGONIUM, Reuss.

416. *Rhabdogonium tricarinatum* (d'Orbigny).

Vaginulina tricarinata, d'Orbigny, 1826, TMC. p. 258, no. 4, Modèle no. 4.
Rhabdogonium tricarinatum, Millett, 1898, etc., FM. 1902, p. 525.

Stations 2, 6, 7.

Frequent at Stations 6 and 7 ; and most typical at Station 6.

MARGINULINA, d'Orbigny.

417. *Marginulina glabra*, d'Orbigny.

Marginulina glabra, d'Orbigny, 1826, TMC. p. 259, no. 6, Modèle no. 55.
„ „ Cushman, 1910, etc., FNP. 1913, p. 79, pl. xxiii, fig. 3.

Stations 2, 3, 6, 7, 27.

Some very fine specimens at Station 6 and a large one at Station 27. Otherwise small and poorly developed.

418. *Marginulina costata* (Batsch).

Nautilus costatus, Batsch, 1791, CS. p. 2, pl. i, fig. 1.
Marginulina costata, Millett, 1898, etc., FM. 1902, p. 526, pl. xi, fig. 20.

Stations 2, 6.

Moderately frequent. All the specimens are small, with many swollen moniliform chambers following the spiral portion, separated by deep sutures. The surface is finely sulcate. They closely resemble Cushman's new species *M. striatula* (C. 1910, etc., FNP. 1913, p. 79, pl. xxiii, fig. 4) in the formation of their chambers, but differ in the coarseness of their markings. In Cushman's species these are so fine as hardly to be indicated in his figure.

VAGINULINA, d'Orbigny.

419. *Vaginulina legumen*, (Linné).

Nautilus legumen, Linné, 1788, SN. (Ed. xiii), p. 3,373, no. 22.
Vaginulina „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 671.

Stations 3, 5–7, 10, 31.

Very fine at Stations 5 and 6, especially the latter. Large fossils at Station 6, smaller at Station 3. Small and recent at the remaining Stations.

420. *Vaginulina bruckenthali*, Neugeboren.

Vaginulina bruckenthali, Neugeboren, 1856, OLS. p. 98, pl. v, fig. 10.
„ „ Brady, 1884, FC. p. 532, pl. lxvi, figs. 18, 19.
„ „ Silvestri, 1896, etc., FPS. 1899, p. 161, pl. vii, fig. 3.

Station 2.

Fine specimens, but broad in proportion to their length, and devoid of the initial spiral.

421. *Vaginulina recta*, var. *parallela*, Halkyard.

Vaginulina recta, var. *parallela*, Halkyard, 1919, BMB. p. 82, pl. v, figs. 5, 6.

Station 6.

A single specimen, agreeing with Halkyard's variety, which, having been created, must be recognized although our views (*ut supra*) remain unaltered.

CRISTELLARIA, Lamarck.

422. *Cristellaria tenuis* (Bornemann).

Marginulina tenuis, Bornemann, 1855, FSH. p. 326, pl. xiii, fig. 14.
Cristellaria ,, Brady, 1884, FC. p. 535, pl. lxvi, figs. 21–23.

Stations 3, 6.

Remarkably fine, long specimens at Station 6.

423. *Cristellaria schloenbachi*, Reuss.

Cristellaria schloenbachi, Reuss, 1862, NHG. p. 65, pl. vi, figs. 14, 15.
,, ,, Cushman, 1910, etc., FNP. 1913, p. 77, pl. xxxvi, fig. 6.

Stations 2, 6.

Rare, but typical, best at Station 6.

424. *Cristellaria tricarinella*, Reuss.

Cristellaria tricarinella, Reuss, 1862, NHG. p. 68, pl. vii, fig. 9 ; pl. xii, figs. 2–4.
,, ,, Brady, 1884, FC. p. 540, pl. lxviii, figs. 3, 4.

Stations 2, 6.

A small fossil specimen at Station 2. At Station 6 frequent and finely developed individuals. Some of these have one or more spines at the aboral end of the shell. The edge is thickened and rounded in all the individuals, some of them showing the rudimentary median keel from which the species derives its name. At Station 6 an abnormal specimen was found in which the young shell, after making six chambers, turned suddenly back and added another six in the same axis but directly opposite to the original line of growth.

425. *Cristellaria variabilis*, Reuss.

Cristellaria variabilis, Reuss, 1849–50, FOT. p. 369, pl. xlvi (i), figs. 15, 16.
,, ,, Cushman, 1910, etc., FNP. 1913, p. 70, pl. xxxvi, figs. 1–3.

Stations 3, 6 (+ R. d. J.).

Excellent recent specimens at both Stations. Fossil also at Station 3.

426. *Cristellaria crepidula* (Fichtel and Moll).

Nautilus crepidula, Fichtel and Moll, 1798, TM. p. 107, pl. xix, figs. *g–i*.
Cristellaria ,, Cushman, 1910, etc., FNP. 1913, p. 70, pl. xxix, figs. 5, 6 ; pl. xxxi, figs. 2–5.

Stations 2, 3, 6, 8, 11, 36 (+ R. d. J.).

Very good specimens, often very large at Stations 2 and 6. Very small at the others, excepting at Station 3, where they are normal. Fossil specimens at Stations 2, 3 and 6.

[Arenaceous isomorph, *Haplophragmium cassis*, Parker.]

427. *Cristellaria cymboides*, d'Orbigny.

Cristellaria cymboides, d'Orbigny, 1846, FFV. p. 85, pl. iii, figs. 30, 31.
" " Burrows, Sherborn and Bailey, 1890, RC. p. 560, pl. xi, fig. 6.
" " Chapman, 1891, etc., GF. 1894, p. 647, pl. ix, fig. 6.

Stations 6, 7.

Good specimens.

428. *Cristellaria acutauricularis* (Fichtel and Moll).

Nautilus acutauricularis, Fichtel and Moll, 1798, p. 102, pl. xviii, figs *g–i*.
Cristellaria " Cushman, 1910, etc., FNP. 1913, p. 69, pl. xxxv, fig. 2.

Stations 2, 6, 7, 36.

Frequent and very typical at Station 6. Less typical at the other N.Z. Stations. Very small, but typical at Station 36.

429. *Cristellaria paucisepta*, Reuss.

Cristellaria paucisepta, Reuss, 1852, SFL. p. 17, figs. *a*, *b*.

Station 18.

A single specimen which appears to represent Reuss's figure. The species named *C. paucisepta* by Seguenza (S. 1879–80, FTR. p. 141, pl. x [error for xiii], fig. 13) is an entirely different form, allied to *C. crassa*. Reuss's paper is probably unknown to most workers in the group.

430. *Cristellaria latifrons*, Brady.

Cristellaria latifrons, Brady, 1884, FC. p. 544, pl. lxviii, fig. 19 ; pl. cxiii, figs. 11, *a*, *b*.
" " Chapman, 1891, etc., GF. 1894, p. 652, pl. x, figs. 8, *a*, *b*.

Station 6.

Frequent and splendidly developed. Some of the specimens attain a great length, the spiral portion representing a quite inconspicuous part of the shell, which becomes rapidly evolute.

431. *Cristellaria italica* (Defrance).

Saracenaria italica, Defrance, Dict. Sci. Nat., 1824, vol. xxxii, p. 177 ; 1827, vol. xlvii, p. 344.
Cristellaria " Cushman, 1910, etc., FNP. 1913, p. 78, pl. xxxiii, fig. 3.

Station 6.

Confined to this Station, where it frequently attains a very large size.

432. *Cristellaria convergens*, Bornemann.

Cristellaria convergens, Bornemann, 1855, FSH. p. 327, pl. xiii, figs. 16, 17.
" " Heron-Allen and Earland, 1916, FWS. p. 262, pl. xlii, figs. 11–14.

Stations 2, 3, 8, 16, 36.

Rare, fossil at Station 3, and the best, though small, at Station 36.

433. *Cristellaria gibba*, d'Orbigny.

Cristellaria gibba, d'Orbigny, 1839, FC. p. 40, pl. vii, figs. 20, 21.
„ „ Cushman, 1910, etc., FNP. 1913, p. 69, pl. xxxv, fig. 1.

Stations 1–3, 6–8, 16, 19, 20.

Excepting at Station 6, where it is frequent and typical and large, the specimens are not noteworthy.

434. *Cristellaria articulata* (Reuss).

Robulina articulata, Reuss, 1863–4, KTF. p. 53, pl. v, fig. 62; pl. vi, fig. 63.
Cristellaria „ Cushman, 1910, etc., FNP. 1913, p. 65, pl. xxxi, fig. 1.

Stations 1, 2, 3, 6, 27.

Confined to the N.Z. area, except for one compressed individual at Station 27. In the N.Z. area it is very large and typical, and also fossil and typical at Station 6. At Stations 1 and 3 not conspicuous. Station 2 is marked by a profusion of wild-growing specimens in every stage of development, from a single fistulose chamber on a normal shell, to larger and more complex and protean examples than those figured by Brady. Incidentally these confirm Brady's judgment in attributing his specimens to *Cristellaria* and disprove Schlumberger's contention that these wild growths are an *Amphicoryne* related to his *A. parasitica* (S., 1892, FAM. p. 197, pl. viii, figs. 10–12). Whatever Schlumberger's form may be (and we suspect that it is identical with Brady's) there is no doubt that Brady's specimens and our own are developments of *C. articulata*.

435. *Cristellaria rotulata* (Lamarck).

Lenticulites rotulata, Lamarck, 1804, AM. p. 188, no. 3; 1816, TEM. pl. 466, fig. 5.
Cristellaria „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 671.

Stations 1–7, 10–12, 18, 36.

Generally distributed down to Station 18, and a broken specimen at Station 36. It often attains considerable size at the N.Z. Stations, especially at Stations 2 and 6. Fossils at Stations 2, 3 and 6.

436. *Cristellaria vortex* (Fichtel and Moll).

Nautilus vortex, Fichtel and Moll, 1798, TM. p. 33, pl. ii, figs. *d–i*.
Cristellaria „ Cushman, 1910, etc., FNP. 1913, p. 68, pl. xxxii, fig. 3.

Stations 1, 2, 3, 6.

Confined to the N.Z. area. Very fine and typical at Station 6.

437. *Cristellaria orbicularis* (d'Orbigny).

Robulina orbicularis, d'Orbigny, 1826, TMC. p. 288, no. 2, pl. xv, figs. 8, 9.
Cristellaria „ Cushman, 1910, etc., FNP. 1913, p. 67, pl. xxxvi, figs. 4, 5.

Stations 1, 2, 6.

Confined to the N.Z. area and rare, except at Station 6, where the specimens are very good.

438. *Cristellaria cultrata* (Montfort).

Robulus cultratus, Montfort, 1808-10, CS. vol. i, p. 214, 54e genre.
Cristellaria cultrata, Heron-Allen and Earland, 1914, etc., FKA, 1915, p. 672.

Stations 1–3, 6, 10, 11, 16, 22, 31 (+ R. d. J.).

Extremely fine and large, and often with splendid development of the keel at Station 6; good also at Station 11, and one enormous broken specimen at Station 16. Otherwise not very frequent or typical.

439. *Cristellaria calcar* (Linné).

Nautilus calcar, Linné, 1767, etc., SN. 1788, p. 3,370, no. 2.
Cristellaria calcar, Cushman, 1910, etc., FNP. 1913, p. 72, pl. xxxii, fig. 4.

Stations 11, 12.

Small specimens only, with the spines weakly developed.

440. *Cristellaria costata* (Fichtel and Moll). Pl. VI, fig. 34.

Nautilus costatus, Fichtel and Moll, 1798, TM. p. 47, pl. iv, figs. *g–i*.
Cristellaria costata, Cushman, 1910, etc., FNP. 1913, p. 75, pl. xxxiv, fig. 4.

Stations 2, 6.

Occurs as recent and finely developed specimens, especially at Station 6. At Station 2, in addition to the type, a thin compressed evolute variety, which we figure, occurs, with sunken sutures, and the limbation running parallel with the outer margin of the test. (Length, 1·50 mm.) This appears to be intermediate between *C. paucicostata*, Cushman, and *C. dorsocostata*, Cushman, but does not exactly conform to any of the many variations of *C. costata* figured by him in his latest monograph on "Foraminifera of the Philippine and Adjacent Seas" (1921, U.S. National Museum, Bulletin 100).

Sub-Family POLYMORPHININAE.

POLYMORPHINA, d'Orbigny.

441. *Polymorphina lactea* (Walker and Jacob).

Serpula lactea, Walker and Jacob, 1798, AEM. p. 634, pl. xiv, fig. 4.
Polymorphina lactea, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 672.

Stations 2, 3, 5.

The best at Stations 2 and 5. Fossils at Stations 2 and 3.

442. *Polymorphina oblonga*, Williamson. Pl. VII, fig. 2.

Polymorphina lactea, var. *oblonga*, Williamson, 1858, RFGB. p. 71, pl. vi, fig. 149.
„ *oblonga*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 672.

Stations 2, 3, 5, 6.

Very fine fossil specimens, but none recent. At Station 5 a specimen, ·70 mm. long, covered entirely with short, stout spines. This, from its appearance, may be either a very well preserved fossil, or a recent specimen. In view of the distinctly fossil character of the other specimens we incline to the former conclusion.

443. *Polymorphina gibba*, d'Orbigny.

Polymorphina (*Globulina*) *gibba*, d'Orbigny, 1826, TMC. p. 266, no. 20, Modèle no. 63.
„ *gibba*, Cushman, 1910, etc., FNP. 1913, p. 85, pl. xli, fig. 4.

Stations 2, 3, 5, 6, 16, 53.

The best specimens in the N.Z. area at Station 5. At the other N.Z. Stations fistulose examples are almost as common as the normal. Fossils at Stations 2, 3 and 6, both normal and fistulose. Outside this area the records depend on single specimens at Stations 16 and 53.

444. *Polymorphina sororia*, Reuss. Pl. VII, fig. 1.

Polymorphina (*Guttulina*) *sororia*, Reuss, 1863, FCA. p. 151, pl. ii, figs. 25–29.
„ *sororia*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 673.

Stations 2, 6, 9, 10, 18, 22, 26, 27, 55.

As a rule the specimens are small, but good at Station 22, and in the N.Z. area, at Stations 2 and 6, both recent and fossil. An interesting recent specimen ·60 mm. long, at Station 6, fistulose and hispid all over.

445. *Polymorphina angusta*, Egger.

Polymorphina angusta, Egger, 1857, MSO. p. 290, pl. xiii, figs. 13–15.
„ „ Brady, 1884, FC. p. 563, pl. lxxii, figs. 1–3.

Station 6, 9, 11, 16, 18, 22 (+ T. d. F.).

Very rare, the best at Stations 16 and 18.

446. *Polymorphina lanceolata*, Reuss.

Polymorphina lanceolata, Reuss, 1851, FSUB. p. 83, pl. vi, fig. 50.
„ „ Cushman, 1910, etc., FNP. 1913, p. 86, pl. xl. fig. 2.

Stations 17, 18.

A good and typical specimen at each Station.

447. *Polymorphina ovata*, d'Orbigny.

Polymorphina ovata, d'Orbigny, 1846, FFV. p. 233, pl. xiii, figs. 1–3.
„ „ Cushman, 1910, FNP. 1913, p. 87, pl. xxx, fig. 2.

Station 2, 18.

One fossil specimen at Station 2, and a small recent example at Station 18.

448. *Polymorphina compressa*, d'Orbigny.

Polymorphina compressa, d'Orbigny, 1846, FFV. p. 233, pl. xii, figs. 32–34.
" " Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 672.

Stations 2, 3, 6, 27.

Fine specimens in the N.Z. area, especially at Station 6. Fistulose at Station 2. Fossils at all the N.Z. Stations. At Station 6 a large abnormal individual intermediate between *P. compressa* and *P. ovata* in the arrangement of the chambers. Outside the N.Z. area the record depends on a single specimen at Station 27. Pearcey's *P. inflata* appears to be merely a pauperate form of this species. P. 1914, SNA. p. 1023, pl. ii, figs. 14–16.

449. *Polymorphina elegantissima*, Parker and Jones.

Polymorphina elegantissima, Parker and Jones, 1865, NAAF. p. 438.
" " Cushman, 1910, etc., FNP. 1913, p. 90, pl. xxxviii, fig. 1.

Stations 1, 2, 3, 5, 6.

This handsome species is the most typical N.Z. representative of the genus. Specimens are abundant and attain large size, especially at Stations 2 and 6. Fossils at Stations 1, 2, 3 and 6. The species does not appear to be subject to fistulose variation.

450. *Polymorphina problema*, d'Orbigny.

Polymorphina problema, d'Orbigny, 1826, TMC. (*Guttulina*), p. 266, no. 14; Modèle (*Polymorphina*) no. 61.
" " Brady, 1884, FC. p. 568, pl. lxxii, fig. 20; pl. lxxiii, fig. 1.
" " Millett, 1898, etc., FM, 1902, p. 264.

Stations 6, 45, 55.

A good series, extending from *P. communis* to the most elongate type of d'Orbigny's *P. oblonga* at Station 6, all recent. A single specimen at Station 45, and two fairly large specimens at Station 55, farthest S.

451. *Polymorphina communis*, d'Orbigny.

Polymorphina (*Guttulina*) *communis* and *problema*, d'Orbigny, 1826, TMC. p. 266, nos. 14 and 15, pl. xii, figs. 1–4; Modèles nos. 61, 62.
" *communis*, Heron-Allen and Earland, 1914, etc., FKA, 1915, p. 673.

Stations 1–3, 5, 6, 48.

Confined to the N.Z. area except for one very small specimen at Station 48. Common at Station 6, where fistulose examples occurred. The largest, perhaps, at Station 1. Fossils at Stations 2, 3 and 6.

452. *Polymorphina rotundata* (Bornemann).

Guttulina rotundata, Bornemann, 1855, FSH. p. 346, pl. xviii, fig. 3.
Polymorphina rotundata, Cushman, 1910, etc., FNP. 1913, p. 88, pl. xl, fig. 1.

Stations 3, 6, 36.

Very rare, and the specimens are not typical.

453. *Polymorphina longicollis*, Brady.

Polymorphina lanceolata, Reuss, 1870, FSP. p. 487 (S. 1870, FSP. pl. xxxi, figs. 25–28).
„ *longicollis*, Cushman, 1910, etc. FNP. 1913, p. 90, pl. xli, figs. 1–3.

Station 16.

Two large individuals, less pointed at the aboral end than Brady's type suggests, and one pointed specimen hispid all over.

UVIGERINA, d'Orbigny.

454. *Uvigerina canariensis*, d'Orbigny.

Uvigerina canariensis, d'Orbigny, 1839, FIC. p. 138, pl. i, figs. 25–27.
„ „ Cushman, 1910, etc., FNP. 1913, p. 92, pl. xlii, fig. 6.

Stations 2, 6, 18, 31 (+ K. I.).

A single good specimen at Station 31. Intermediate forms at the other Stations.

455. *Uvigerina pygmaea*, d'Orbigny.

Uvigerina pygmaea, d'Orbigny, 1826, TMC. p. 269, pl. xii, figs. 8, 9 ; Modèle no. 67.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 675.

Stations 3, 4, 6–12, 14, 16, 32, 49, 55 (+ K. I., R. d. J., D.).

Generally distributed, especially good in the N.Z. area, particularly at Stations 10–12, where it attains a great size and is very variable, passing imperceptibly into *U. angulosa* and *aculeata*. At Stations 11 and 12 both long and short forms occur, and at Station 12 the long forms are spinous on the primordial chambers. In the deep water, good specimens at Station 16, short type only at Station 32. It passes into *U. angulosa* at Station 49. At Station 55, farthest South, the specimens are small.

456. *Uvigerina angulosa*, Williamson.

Uvigerina angulosa, Williamson, 1858, RFGB. p. 67, pl. v, fig. 140.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 676.

Stations 1–3, 5–9, 11, 12, 14, 16, 18, 22, 26, 27, 29–32, 38, 41, 45–50, 53–55 (+ R. d. J., D.).

Common and almost universally distributed. As might be expected with such an enormous range of latitude and depth, the specimens include variations of every nature. The finest in the N.Z. area are at Stations 2 and 6. In the deep-water area the species is less abundant and less variable, but with shallow gatherings (Stations 26 and 27) it resumes its predominance and its wild tendency to variation, both in length and nature of markings ; finely striate and sulcate,

hispid at Station 27, where specimens passing imperceptibly into *U. aculeata* and *U. pygmaea* occur, as also at Stations 38, 45, 53, and 54. At the southernmost Stations it is one of the most common and best developed Foraminifera. Fossil specimens at Stations 2, 3 and 6.

457. *Uvigerina brunnensis*, Karrer.

Uvigerina brunnensis, Karrer, 1877, HW. p. 385, pl. xvi, (*b*), fig. 49.
„ „ Cushman, 1910, etc., FNP. 1913, p. 97, pl. xliii, fig. 2.

Station 11.
A few fairly distinctive specimens.

458. *Uvigerina aculeata*, d'Orbigny.

Uvigerina aculeata, d'Orbigny, 1846, FFV. p. 191, pl. xi, figs. 27, 28.
„ „ Cushman, 1910, etc., FNP. 1913, p. 100, pl. xliii, fig. 4.

Stations 6, 10, 11, 16, 18, 22 (+ D.).
This species has its headquarters at Station 6, where it reaches an enormous size and very fine development of the spines, which often extend all over the shell. At the other Stations the specimens are less abundant and less strongly developed, but very good at Station 18. There is the usual tendency to run imperceptibly into *U. pygmaea*, *angulosa*, and *asperula*.

459. *Uvigerina asperula*, Czjzek.

Uvigerina asperula, Czjzek, 1848, FWB. p. 146, pl. xiii, figs. 14, 15.
„ „ Cushman, 1910, etc., FNP. 1913, p. 101, pl. xliii, fig. 1.

Stations 6–8, 10–12, 14, 22, 23, 27, 31, 36 (+ D.).
Occurs in the N.Z. area and northerly Antarctic. In the N.Z. area best at Stations 6, 7 and 10 and passes into var. *ampullacea*. In the deep water the best Station is 22, where very fine specimens occur. At Station 23 the surface is covered with very long delicate spines (setose); at Station 27 it is hardly separable from *U. angulosa*, which at this Station becomes spinous.

460. *Uvigerina asperula*, var. *ampullacea*, Brady.

Uvigerina asperula, var. *ampullacea*, Brady, 1884, FC. p. 579, pl. lxxv, figs. 10, 11.
„ „ „ „ Cushman, 1910, etc., FNP. 1913, p. 102, pl. xlii, fig. 3.

Stations 6, 7, 10 (+ R. d. J.).
Good examples at each Station.

461. *Uvigerina auberiana*, d'Orbigny.

Uvigerina auberiana, d'Orbigny, 1839, FC. p. 106, pl. ii, figs. 23, 24.
„ „ Cushman, 1910, etc., FNP. 1913, p. 102, pl. xxxvii, fig. 5.

Station 7.
A single specimen.

462. *Uvigerina auberiana*, var. *glabra*, Millett.

Uvigerina auberiana, d'Orbigny, 1839, FC. p. 106, pl. ii, figs. 23, 24.
„ „ var. *glabra*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 674.

Station 6.
A few typical specimens.

463. *Uvigerina interrupta*, Brady.

Uvigerina interrupta, Brady, 1879, etc., RRC, 1879, p. 274, pl. viii, figs. 17, 18; 1884, FC. p. 580, pl. lxxv, figs. 12–14.
„ „ Cushman, 1910, etc., FNP. 1913, p. 103, pl. xliv, fig. 1.

Station 6.
Very fine and elongate, delicately spinous specimens.

SAGRINA, d'Orbigny, emend. Parker and Jones.

The genus *Sagrina* makes its first appearance in d'Orbigny's monograph on the Cuban Foraminifera (1839), and was named by him after de la Sagra, of whose work on the Island it formed an integral part. Bronn in 1851, Reuss in 1865 (models), Marsson in 1878 and others subsequently, have adopted the name *Sagraina*, which is obviously more correct in the circumstances. We prefer, however, to adhere to the original spelling.

The name *Siphogenerina* was coined by Schlumberger in 1883 to include all those Foraminifera in which the aperture extended in the form of a siphon, or tube, through the successive chambers of growth. This method of classification, though perhaps taxonomically convenient, is false zoologically, because species, widely separated generically, present this feature in common, whereas individuals of the same genus in some species possess a siphon and in others lack it. Even within the limits of a species the presence or absence of a siphon may be observed, as in *Sagrina raphanus*, which has sometimes an external neck and no siphon, and in others has no neck, but has the internal tube. Considerable confusion has thus been introduced into synonymies, and we think that Schlumberger's generic name should be abandoned and the species be redistributed among the genera to which they undoubtedly belong.

464. *Sagrina columellaris*, Brady.

Sagrina columellaris, Brady, 1879, etc., RRC. 1881, p. 64; 1884, FC. p. 581, vol. lxxv, figs. 15–17.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 676.

Stations 5, 6.
Very rare, recent specimens.

465. *Sagrina bifrons*, Brady.

Sagrina bifrons, Brady, 1879, etc., RRC. 1881, p. 64; 1884, FC. p. 582, pl. lxxv, figs. 18–20.
Siphogenerina bifrons, Cushman, 1910, etc., FNP, 1913, p. 105, pl. xlv, figs. 1, 2, 5–7.

Stations 2, 3, 6.

All the specimens are fossils, and exhibit every possible variation of multiformity. Sometimes the biserial or triserial chambers occupy a large portion of the test, in others they are merely indicated at the aboral end. Many of the specimens are feebly striate, passing into *S. striata*.

466. *Sagrina dimorpha*, Parker and Jones.

Uvigerina (*Sagrina*) *dimorpha*, Parker and Jones, 1865, NAAF. p. 364, pl. xviii, fig. 18.
Sagrina dimorpha, Heron-Allen and Earland, 1916, FWS. p. 266, pl. xlii, figs. 17, 18.

Stations 3, 6, 7, 10, 11.

Confined to the N.Z. area; very rare, but quite typical.

467. *Sagrina virgula*, Brady.

Sagrina virgula, Brady, 1879, etc., RRC. 1879, p. 275, pl. viii, figs. 19–21.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 676, pl. li, figs. 4, 5.

Station 16.

A single specimen of the deep-water type with large cup-shaped orifice.

468. *Sagrina striata* (Schwager).

Dimorphina striata, Schwager, 1866, FKN. p. 251, pl. vii, fig. 99 and text-fig. 2.
Sagrina „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 676, pl. li, figs. 6–8.

Stations 2 and 3.

Rare, all fossils.

469. *Sagrina raphanus*, Parker and Jones.

Uvigerina (*Sagrina*) *raphanus*, Parker and Jones, 1865, NAAF. p. 364, pl. xviii, figs. 16–17.
Sagrina raphanus, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 677.

Stations 1, 2.

At Station 1 strongly marked, thick-shelled, entosolenian, and recent. At Station 2 a single small, and rather uncertain, fossil example with a produced neck.

Sub-Family RAMULININAE.

RAMULINA, Rupert Jones.

470. *Ramulina globulifera*, Brady.

Ramulina globulifera, Brady, 1879, etc., RRC. 1879, p. 272, pl. viii, figs. 32, 33; 1884, FC. p. 587, pl. lxxvi, figs. 22–23.
„ „ Cushman, 1910, etc., FNP. 1913, p. 110, pl. xxxix, fig. 1.

Stations 3, 6, 11.

Fragments of tubes at Stations 3 and 11; at Station 6 a good series of specimens, often of considerable size, showing the branching arms diverging from the globular chambers.

471. *Ramulina* (?), Text-figure.

Station 2.

A single example of a very large abnormal organism, the precise nature of which can only be a matter of speculation. It can best be compared with the fistulose outgrowths of the *racemosa* type figured by Jones and Chapman (J. & C. 1896–8, FPR. p. 504, figs. 17–19), but it differs from anything of this nature that can be imagined in its enormous size. It is difficult to imagine any single individual *Polymorphina* extruding sufficient protoplasm to form such a mass of labyrinthic tubes. Many of the extensions are broken, but here and there nipple-like apertures may be traced on the projecting tubes. Perhaps the nearest organism hitherto figured with which it may be compared is the *R. grimaldii*, Schlumberger (Note sur le *R. grimaldii*, Mém. Soc. Zool., France, vol. iv, 1891, pp. 509–511 (151–153 in reprint), pl. v), but this abnormal form differs considerably and is of a less complicated structure. Our organism measures 5 by 3 mm. and has a depth of 2 mm.

Family GLOBIGERINIDAE.

GLOBIGERINA, d'Orbigny.

472. *Globigerina bulloides*, d'Orbigny.

Globigerina bulloides, d'Orbigny, 1826, TMC. p. 277, no. 1 ; Modèles nos. 17 and 76.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 678.

Stations 1–12, 14, 16, 19, 23, 26–29, 31, 32, 38, 41, 48, 50, 53 (+ T. d. F., K. I., D.).

Universally distributed, and in the N.Z. area splendidly developed and characteristic, especially at Stations 2, 3 and 6, where a large number of specimens were of pelagic origin. At Stations 10, 11, 12 large benthic individuals. There is a considerable range of variation in the direction of *G. dubia* at Station 6, and of *G. dutertrei* at Stations 5, 6 and 7, also at Station 16, and from Station 27. To the south the typical *G. bulloides* gradually dies out and the specimens found might equally be referred to *G. dutertrei*.

[Arenaceous isomorph, *Haplophragmium globigeriniforme* (P. & J.).]

473. *Globigerina triloba*, Reuss.

Globigerina triloba, Reuss, 1849–50, FOT. p. 374, pl. ii (xlvii), fig. 11.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 678.

Stations 1–3, 5–7, 9, 11 (+ K. I., R. d. J.).

Confined to the N.Z. area, the best at Stations 2 and 6. The size of the

hexagonal pits surrounding the tubuli is noticeably larger in this species than in *G. bulloides*.

474. *Globigerina dubia*, Egger.

Globigerina dubia, Egger, 1857, MSO. p. 281, pl. v (ix), figs. 7–9.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 678.

Stations 2, 3, 6, 7, 8, 11, 12, 27 (+ T. d. F., R. d. J., D.).

Very large and characteristic specimens at Stations 2, 3 and 6. Outside these Stations the specimens are few in number and smaller and much less characteristic.

[Arenaceous isomorph, *Haplophragmium globigeriniforme*, (P. & J.) (*pars*) = *Trochammina subturbinata*, Cush. (C., 1920, FAO. p. 81, pl. xvi, figs. 7, 8).]

475. *Globigerina cretacea*, d'Orbigny.

Globigerina cretacea, d'Orbigny, 1840, CBP. p. 34, pl. iii, figs. 12–14.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 678, pl. li, figs. 10–13.

Stations 18, 20, 26 (+ T. d. F.).

Very rare. The best examples at Station 18.

476. *Globigerina cretacea*, var. *eggeri*, nov. Pl. VII, figs. 6–8.

Globigerina aequilateralis, Egger, 1899, KOA. p. 169, pl. xxi, figs. 11, 21–23 ; 1910, FKR, p. 36, pl. iv, figs. 17–19.

Station 6.

A single delicate specimen, ·22 mm. in diameter, exhibiting seven chambers on the inferior side, and two complete whorls of chambers on the upper or rotaline surface. It is clearly allied to the *G. cretacea* group, but does not agree with either the type or the species *sub-cretacea* instituted by Chapman for the recent forms of *G. cretacea* figured by Brady (C., 1901, FFA. p. 410, pl. xxxvi, fig. 16). On the other hand the N.Z. specimen does very closely resemble a little form which has been figured by several authors under the name *G. aequilateralis*, Brady, disregarding the fact that *G. aequilateralis* should, as its name suggests, be aequilateral, presenting a similar appearance on both faces. We have associated our variety with the name of Egger, who is responsible for the original misapplication of the name *G. aequilateralis*.

These small, compressed rotaline Globigerinae are very rare, but we have observed them before in several tropical and sub-tropical gatherings.

477. *Globigerina inflata*, d'Orbigny.

Globigerina inflata, d'Orbigny, 1839, FIC. p. 134, pl. ii, figs. 7–9.
,, ,, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 679.

Stations 1–12, 31, 32, 52 (+ T. d. F., D.).

Universal in the N.Z. area, often abundant, and remarkably well developed,

especially at Stations 2, 3 and 6. Fossils at Stations 2 and 3. Outside the N.Z. area the records are few and the specimens poor.

[Arenaceous isomorph, *Haplophragmium globigeriniforme* (P. & J.) (*pars*) = *Trochammina globulosa*, Cush. (C., 1920, FAO. p. 77, pl. xvi, figs. 3, 4).]

478. *Globigerina dutertrei*, d'Orbigny.

Globigerina dutertrei, d'Orbigny, 1839, FC. p. 84, pl. iv, figs. 19–21.
,, ,, Brady, 1884, FC. p. 601, pl. lxxxi, figs. 1, *a–c*.
,, *bulloides*, Murray and Renard, 1891, Chall. Rep. Deep Sea Deposits, pp. 163, 165, 214, 261, pl. xv, fig. 1 (3).
,, *dutertrei*, Chapman, 1909, SNZ. p. 350; 1914, FORS. p. 69, pl. v, fig. 36.
,, ,, Pearcey, 1914, SNA. p. 1,024.
,, *bulloides*, Fauré Fremiet, 1913, etc., FMAF. 1913, p. 264; 1914, p. 6, pl. 0, fig. 10.
,, *dutertrei*, Sidebottom, 1918, FECA. p. 150, pl. v, figs. 25–27.

Stations 1–3, 5, 6, 8–11, 13–20, 22–24, 26–38, 41, 42, 45–48, 50, 53–55 (+ T. d. F., K. I., R. d. J., D.).

Note.—In 1839 d'Orbigny figured this species as a somewhat high, inflated, rotaliform type, having a single small-looped aperture visible only on the underside, and confined to the last chamber. His specimen was evidently drawn from a thin-walled surface-, or shallow-water, specimen. It represents a very distinctive type, differing considerably from *G. bulloides* (which it closely resembles as seen from the superior side), in having this single aperture to the final chamber, instead of each chamber opening, as in *G. bulloides*, into the umbilical recess. After the Cuba monograph the species seems to have been entirely ignored, and although it occurs commonly in company with *G. bulloides*, and much work was done with the *Globigerina* oozes, it was not separated again until Brady dealt with the "Challenger" Collections, when he re-figured the species, using a thick-walled benthic specimen as his type, his figure thus differing slightly from d'Orbigny's. But he fully recognized the distinctness and importance of the type, though curiously enough it is not represented in his table of Globigerinae found in the various types of deep-sea deposits, including *Globigerina* ooze, although it does figure in his table of characteristic Foraminifera from high latitudes north and south. Even there it figures from one Station only in the Antarctic, and from none of the Arctic gatherings. It is probable that these records of material were not worked out by Brady himself, but by assistants, who failed to distinguish the type, with the result that Brady in his Report (p. 601), commits himself to a statement that "*G. dutertrei* takes the place of the typical *G. bulloides* in the Antarctic Seas, just as *G. pachyderma* represents the type in Arctic latitudes."

This is not the case; our own examination of material from the northern North Sea had long ago proved to us that *G. dutertrei* gradually replaces *G. bulloides* as we go north, and now our work on the "Terra Nova" material proves

that it extends equally far to the south, and that in the most southerly latitudes it is more or less replaced by *G. pachyderma*, as in the Arctic Seas.

Dr. Harvey Pirie, in his Memoir on "The Deep Sea Deposits of the Scottish National Antarctic Expedition" (P., 1913, SNA.), records the presence of the two forms together in many of the deposits examined by him.

G. dutertrei becomes the dominant type at Station 16, where the Foraminifera in the material consisted of 95 per cent. of this species; and at Stations 17, 18 and 20 at least 99 per cent. of the whole material as dredged. South of these Stations the nature of the material becomes normally varied, with a corresponding decrease in the number of the Globigerinae.

Universally distributed, but in the N.Z. area rare, except at Station 9, where many very good examples were found. In the deep water those soundings, which were *Globigerina* oozes, consisted almost entirely of this species, as recorded above. In the Antarctic coastal area the Globigerinae naturally form a smaller percentage, but *G. dutertrei* retains its dominant position among the Globigerinae, becoming more thick-shelled, starved and approximating by imperceptible degrees to *G. pachyderma*, until at many Stations it is difficult to draw a line by which the specimens of the species can be separated from the other. Well-marked individuals of *G. dutertrei*, however, occur everywhere and particularly at Stations 36, 38 and 53. At the dominant Stations large numbers of abnormal and wild-growing specimens occur, ranging between double individuals inseparable from *G. helicina*, to "sports" in which individual chambers are malformed and tubular, in fact the species seems more subject to these biological malformations than any other Globigerinae. Many of the benthic specimens also exhibit excessive thickening of the shell-wall by the deposition of concentric layers of calcium carbonate. Such thickening, by obliterating the sutural depressions, brings the smaller specimens into practical identity with *G. pachyderma* when the oral aperture is of a depressed character.

Kiaer (K., 1899, NNAE, pl. i, fig. 7) figures similar specimens with tubular outgrowths as "*Globigerina* sp." from the Arctic Seas.

[Arenaceous isomorph, *Haplophragmium globigeriniforme*, P. & J.]

479. *Globigerina pachyderma* (Ehrenberg).

Aristerospira pachyderma, Ehrenberg, 1873, LMT. p. 386, pl. i, fig. 4.
,, *crassa*, Ehrenberg, *ibid*, p. 388, pl. iii, fig. 9.
Globigerina omphalotetras, Ehrenberg, *ibid*, p. 388, pl. iii, fig. 11.
,, *bulloides*, Brady, 1878, RRNP ("Arctic variety") p. 435, pl. xxi, fig. 10.
,, ,, var. *borealis*, Brady, 1882, FKE. p. 716, 717.
,, *pachyderma*, Brady, 1884, p. 600, pl. cxiv, figs. 19, 20.
,, ,, Murray and Renard, 1891, Chall. Rep. "Deep Sea Deposits," p. 260, pl. xxv, fig. 12.
,, ,, Heron-Allen and Earland, 1908, etc., SB 1909, p. 438, pl. xviii, figs. 4, 5.
,, ,, Pearcey, 1914, SNA. p. 1,024 (*c*).

Stations 2, 3, 5, 11, 13, 15, 18, 20, 26–31, 33, 35–38, 42, 45–48, 50, 52–55 (+ K. I., D.).

Note.—The early Bibliography of this species has been fully dealt with by Brady (*ut supra*). He appears to have been convinced that it was a purely Arctic form, and failed to record it in the Antarctic gatherings of the "Challenger." Pearcey, dealing with the "Scotia" material, and having practical knowledge of northern gatherings in which *G. pachyderma* occurs, recognized the form in the south, and recorded it from the Antarctic. It does not occur in Chapman's Antarctic records. We are still uncertain as to the specific value of the species. The evidence, in our opinion, rather tends in the direction that it is a varietal form due to the suppression of the comparatively large single aperture of the typical *G. dutertrei*, combined with a reduction of the general dimensions, and particularly with a massive thickening of the shell-wall. In any large assemblage of specimens of *G. dutertrei* it is not difficult to find a series in which the aperture ranges from a high arch to a narrow slit, and when this last form assumes a thick shell-wall obliterating the sutural lines, we reach a specimen which is practically indistinguishable from typical *G. pachyderma*.

In the N.Z. area the specimens are few in number. At Stations 2 and 3 their nature is more or less uncertain; they may possibly be excessively thick-walled and starved individuals of *G. inflata*. At Stations 5 and 11, however, the few individuals are typical. South of N.Z. the form increases in frequency; very good specimens occur at Station 28, and as one approaches the South Pole the proportion of typical specimens as compared with thick-walled transition-stages of *G. dutertrei* increases. The only Station at which *G. pachyderma* is recorded and not *G. dutertrei*, is Station 52.

480. *Globigerina rubra*, d'Orbigny.

Globigerina rubra, d'Orbigny, 1839, FC. p. 82, pl. iv, figs. 12, 14.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 679.

Stations 1–3, 6, 7, 54 (+ R. d. J.).

Never common, but good typical specimens at Stations 2, 3, and 6, and a single good one at Station 54. Only two specimens were found showing the characteristic red colour (Stations 2 and 6).

481. *Globigerina rubra*, var. *elevata*, d'Orbigny.

Globigerina elevata, d'Orbigny, 1840, CBP. p. 34, pl. iii, figs. 15, 16.
„ *trochoides*, Reuss, 1845–6, VBK. (1), p. 36, pl. xii, fig. 22.
„ sp. (?) *rubra*, Brady, 1884, FC. p. 603, pl. lxxxii, figs. 8, 9.
„ *rubra* (?), Chaster, 1892, FS, p. 64.
„ „ Heron-Allen and Earland, 1913, CI. p. 105; 1913, FNS. p. 131, pl. x, figs. 13, 15.

Stations 8–11, 14, 31, 36.

Abundant and very finely developed at Station 10. The occurrence of this little form as a predominant type in an area so far removed from the British coasts, where it has been consistently recorded as *G. rubra*, renders it necessary to revive the d'Orbignyan name. It is probably one of the universally distributed Foraminifera, but, by reason of its minute size, it escapes observation or is regarded as an immature test.

482. *Globigerina conglobata*, Brady.

Globigerina conglobata, Brady, 1879, etc., RRC. 1879, p. 286; 1884, F.C. p. 603, pl. lxxx, figs. 1–5.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 680.

Stations 2, 6, 7, 12, 48.

Large and very typical at Stations 2 and 6, less typical at the others. Small fossil specimens at Station 2.

483. *Globigerina sacculifera*, Brady.

Globigerina sacculifera, Brady, 1877, FNB. p. 535; 1884, FC. p. 604, pl. lxxx, figs. 11–17.
„ „ Millett, 1898, etc., FM. 1903, p. 688.

Stations 6, 7.

The best specimens at Station 6.

484. *Globigerina helicina*, d'Orbigny.

Globigerina helicina, d'Orbigny, 1826, TMC. p. 277, no. 5.
„ „ Cushman, 1910, etc., FNP. 1914, p. 12, pl. iii, figs. 1, 2.

Stations 6, 16, 18–20, 22, 23, 27, 36 (+ D.).

The specimens at Station 6 are poor, at the others much more distinctive, especially at Station 18. Brady has already questioned the specific value of this species, which he was inclined to regard as merely a monstrous variety of other species. The evidence from this material strongly supports this. At Stations where *G. helicina* occurs *G. dutertrei* is a predominant form, and nearly all our specimens of *G. helicina* show at least one character characteristic of *G. dutertrei*. Brady's figures, on the other hand, suggest a *G. conglobata* origin.

485. *Globigerina aequilateralis*, Brady.

Globigerina aequilateralis, Brady, 1879, etc., RRC. 1879, p. 285; 1884, FC. p. 605, pl. lxxx, figs. 18–21.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 680.

Stations 2, 3, 6, 7, 12 (+ R. d. J.).

N.Z. area only. Magnificent specimens at Stations 2, 3 and 6, including a spinous pelagic specimen at the latter. Less well developed at Stations 7 and 12. Fossils at Stations 2, 3 and 6 also. (*See* our note under *G. cretacea*, var. *eggeri*, no. 476.)

ORBULINA, d'Orbigny.

486. *Orbulina universa*, d'Orbigny.

Orbulina universa, d'Orbigny, 1839, FC. p. 3, pl. i, fig. 1.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 681.

Stations 1–12, 38 (+ R. d. J.).

Universal in the N.Z. area. A single thick-walled bottom specimen at Station 38. The N.Z. series is very complete and exhibits practically every recorded variation, as regards size, thin-walled pelagic, thick-walled benthic. Double specimens (=*O. bilobata*, d'Orb.) occur at Stations 2, 3, 6. Triple individuals at Stations 3 and 6. At Stations 2, 3, 6, 8 and 11, specimens occur in which the orbuline sphere does not entirely enclose the inner globigerine shell, which projects from the outer surface. In those at Station 2 the globigerine chambers are very coarsely pitted, so that the specimens were at first referred to *O. porosa*, Terquem, which probably owes its creation to such abnormal types as these (T. 1858, etc., FLM. 1858, p. 633, pl. iv, fig. 16).

[Arenaceous isomorph, *Thurammina papillata*, Brady.]

HASTIGERINA, Wyville Thomson.

487. *Hastigerina pelagica* (d'Orbigny).

Nonionina pelagica, d'Orbigny, 1839, FAM. p. 27, pl. iii, figs. 13, 14 (1, 2, in text).
Hastigerina ,, Cushman, 1910, etc., FNP. 1914, p. 15, pl. viii, figs. 1–8.

Stations 3, 6.

A single specimen at Station 3 and many excellent ones at Station 6, all presumably fossils, judging by their appearance.

PULLENIA, Parker and Jones.

488. *Pullenia obliquiloculata*, Parker and Jones.

Pullenia obliquiloculata, Parker and Jones, 1865, NAAF. pp. 368, 421, pl. xix, fig. 4.
,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 681.

Stations 1–3, 6–12, 16 (+ T. d. F.).

Generally distributed in the N.Z area. Very fine specimens at Stations 1, 2 and 6, thin-walled and hyaline. Very thick benthic specimens at Station 7. Benthic specimens sometimes attaining a large size, especially at Stations 10 and 12. Outside the N.Z. area recorded only as benthic at Station 16.

489. *Pullenia quinqueloba* (Reuss).

Nonionina quinqueloba, Reuss, 1851, FSUB. p. 71, pl. v, figs. 31*a*, *b*.
Pullenia ,, Cushman, 1910, etc., FNP. 1914, p. 21, pl. xiii, fig. 2.

Stations 2, 3, 6–8, 10–12, 16–18, 20, 22, 23, 27, 31, 32, 36, 38, 45, 46, 48–50, 52–54 (+ R. d. J.).

Universally distributed and showing no signs of decrease in size or development as we go south. The number of chambers varies between four and seven; in fact at some Stations six-chambered specimens are almost as abundant as the normal type. Best in the N.Z. area at Stations 6, 10, 11 and 12; at the last two Stations there is a tendency to inflation, bringing them very near to *P. sphaeroides*, indeed the four-chambered specimens at these two Stations may be regarded either as compressed *P. sphaeroides* or inflated *P. quinqueloba*. Similar inflated specimens, sometimes with lobulate edge, at Stations 18 and 22. The species attains its best dimensions at Antarctic Stations 36, 38, 45, 48 and 50. Six-chambered specimens at Station 45, 48 and others, and seven-chambered at Stations 38 and 50. Fossil specimens only at Stations 2 and 3, also at Station 6 with excellent recent ones.

490. *Pullenia sphaeroides* (d'Orbigny).

Nonionina sphaeroides, d'Orbigny, 1826, TMC. p. 293, no. 1, Modèle no. 43.
Pullenia ,, Cushman, 1910, etc., FNP. 1914, p. 20, pl. xi, fig. 2.

Stations 3, 6–8, 10–12, 16–20, 22, 23, 29, 36 (+ T. d. F.).

Best in the N.Z. area at Stations 7 and 11, where it is very fine. Outside this area best at Station 16, where it is very large, and at Station 22, where five-chambered specimens occur. Small at most of the other southerly Stations. Compressed individuals at Stations 7, 11, 16, 19, 29 and 36.

SPHAEROIDINA, d'Orbigny.

491. *Sphaeroidina bulloides*, d'Orbigny.

Sphaeroidina bulloides, d'Orbigny, 1826, TMC. p. 267, no. 1, Modèle no. 65.
,, ,, Cushman, 1910, etc., FNP. 1914, p. 18, pl. x, fig. 7; pl. xii, fig. 1.

Stations 1, 3, 6–12, 14, 16, 17, 19, 31, 32, 36, 41, 45, 55.

Generally distributed, but nowhere abundant, except at Station 17, where it is common, but the specimens are small. Stations 10 and 11 are the best, where it is frequent, finely-developed and large. At the remaining Stations the records mostly depend upon a single specimen.

[Arenaceous isomorph, *Haplophragmium sphaeroidiniforme*, Brady.]

492. *Sphaeroidina dehiscens*, Parker and Jones.

Sphaeroidina dehiscens, Parker and Jones, 1865, NAAF. p. 369, pl. xix, fig. 5.
,, ,, Cushman, 1910, etc., FNP. 1914, p. 19, pl. x, fig. 2; pl. xiii, fig. 1.

Stations 6, 7.

Extremely rare, but typical.

Family ROTALIIDAE.

Sub-Family SPIRILLININAE.

SPIRILLINA, Ehrenberg.

493. *Spirillina vivipara*, Ehrenberg. Pl. VII, Fig. 4.

Spirillina vivipara, Ehrenberg, 1841, SNA. p. 442, pl. iii, fig. 41.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 683, pl. li, figs. 19–23.

Stations 2, 4, 6, 31, 38, 45, 47, 53, 55 (+ R. d. J., D.).

Absent from all deep-water Stations, but otherwise generally distributed. At Station 2 specimens attached to stones, and also examples of a curious and pretty variety characterized by a dome-shell with a single row of perforations (?) following the middle line of the tube, giving a decorate appearance to the shell, but otherwise typically *S. vivipara*. This compares in some respects with Chapman's *S. decorata*, var. *unilatera* (C., 1901, etc., FFA. 1902, p. 410, pl. xxxvi, fig. 17). At Station 6 in addition to the best series of the normal type, Rhumbler's var. *revertens* occurs (R., 1906, FLC. p. 32, pl. ii, figs. 8–10), in which the oral end of the tube is imperceptibly turned in and fused with the preceding whorl, so as to show no demonstrable aperture. At the S. Polar Stations 45, 53 and 55, all the specimens represent a convex and dome-like type. At Station 53 one specimen is attached to a Zoophyte, and another free specimen of this type has three young individuals inside the concave base of the shell, each of the young showing a primordial chamber and one complete spiral.

[Porcellanous isomorph, *Cornuspira involvens*, Reuss, and *foliacea* (Phil.), Arenaceous isomorph, *Ammodiscus incertus*, d'Orb., and *tenuis*, Brady.]

494. *Spirillina obconica*, Brady.

Spirillina obconica, Brady, 1879, etc., RRC. 1879, p. 279, pl. viii, fig. 27; 1884, FC. p. 630, pl. lxxxv, figs. 6, 7.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 683.

Stations 2, 6, 26, 31, 53, 55.

Widely scattered records. Remarkably good at Stations 26 and 31, a very fine attached specimen of very decorate appearance, owing to the regular spacing of the perforations along the tube at Station 2. The remaining specimens small.

[Porcellanous isomorph, *Cornuspira polygyra*, Reuss, *fide* Hantken (H., 1875, CSS. p. 19, pl. ii, fig. 1).]

495. *Spirillina obconica*, var. *carinata*, Halkyard.

Spirillina vivipara, var. *carinata*, Halkyard, 1889, RFJ. p. 69, pl. ii, fig. 6.
,, *obconica*, ,, ,, Heron-Allen and Earland, 1916, FWS. p. 269.

Stations 53, 55.

Several fine examples at our southernmost limit.

496. *Spirillina lucida*, Sidebottom.

Spirillina lucida, Sidebottom, 1904, etc., RFD. 1908, p. 9, pl. ii, fig. 9.
„ „ Heron-Allen and Earland, 1908, etc., SB. 1911, p. 327; 1913, CI. p. 108, pl. ix, figs. 4, 5.

Station 6.
A single typical specimen

497. *Spirillina ornata*, Sidebottom.

Spirillina ornata, Sidebottom, 1904, etc., RFD. 1908, p. 9, pl. ii, figs. 7, 8.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 684, pl. li, figs. 24, 25.

Station 6.
A single typical specimen.

498. *Spirillina inaequalis*, Brady.

Spirillina inaequalis, Brady, 1879, etc., RRC. 1879, p. 278, pl. viii, fig. 25.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 634.

Stations 2, 6.
Very rare, but typical.

499. *Spirillina tuberculata*, Brady.

Spirillina tuberculata, Brady, 1879, etc., RRC. 1879, p. 279, pl. viii, fig. 28 (see also Siddall, 1878, FRD. p. 49).
„ „ Brady, 1884, FC. p. 631, pl. lxxxv, figs. 12–16.

Stations 31, 38, 48.
Large and strongly marked specimens at Stations 31 and 38; weaker at Station 48.

500. *Spirillina novae-zealandiae*, Chapman.

Spirillina nova-zealandiae, Chapman, 1909, SNZ. p. 352, pl. xvii, figs. 4, 5.

Stations 1–3, 5.
Very fine examples, especially at Station 1.

501. *Spirillina limbata*, Brady.

Spirillina limbata, Brady, 1879, etc., RRC. 1879, p. 278, pl. viii, fig. 26.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 684.

Stations 2, 3, 26.
A very fine series of recent specimens at Station 2. Less typical at Station 3. A single large individual attached to a Zoophyte at Station 26.
[Porcellanous isomorph, *Cornuspira oligogyra*, Hantken (H., 1875, CSS. p. 20, pl. i, fig. 10).]

502. *Spirillina limbata*, var. *denticulata*, Brady.

Spirillina limbata, var. *denticulata*, Brady, 1884, FC. p. 632, pl. lxxxv, fig. 17.
,, ,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 685.

Station 2.

Among the fine series of *S. limbata*, at Station 2, are forms intermediate between that species and Brady's variety ; every stage in the transition is represented.

503. *Spirillina margaritifera*, Williamson.

Spirillina margaritifera, Williamson, 1858, RFGB. p. 93, pl. vii, fig. 204.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 685.

Stations 2, 4, 6.

Very fine examples at Station 2, almost equally good at Station 6.

504. *Spirillina decorata*, Brady.

Spirillina decorata, Brady, 1884, FC. p. 633, pl. lxxxv, figs. 22–25.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 685.

Stations 2, 3, 5, 26, 31, 48.

A very handsome set of specimens, but nowhere strictly typical, except at Station 31, where they are very strong. At Stations 2, 3 and 5 the specimens follow Brady's type, but the convolutions are more embracing on the upper surface, and, when worn away, they exhibit strong crossbars which suggest a sub-division of part of the tube into chamberlets. At Stations 26 and 48 some very large specimens, which represent an intermediate form between *S. decorata* and *S. tuberculata*, the upper surface being more or less normal but tuberculate, and the under surface being so strongly tuberculate that the convolutions are masked. In a few of the examples the markings are almost equally strong on the upper surface.

505. *Spirillina selseyensis*, Heron-Allen and Earland. Pl. VII, fig. 3.

Spirillina selseyensis, Heron-Allen and Earland, 1908, etc., SB. 1909, p. 440, pl. xviii, figs. 6, 7.
,, (=*restis* Halkyard) Halkyard. 1919, BMB. p. 105, pl. vi, fig. 6 ; pl. vii, fig. 8.

Station 2.

A single damaged specimen at Station 2, which we refer to the above species in preference to creating a new one, although it differs in some respects from the Selsey specimens. The upper surface resembles *S. limbata*, var. *denticulata*, and the under surface, a closely coiled spiral of rope. In the typical *S. selseyensis* the marginal edge is furnished with a keel which cuts off the spiral marking from the outer circumference of the organism. In the N.Z. specimen there is no marginal keel, and the peripheral edge, as may be seen from our figure, is deeply and regularly grooved.

Sub-Family ROTALIINAE.

PATELLINA, Williamson.

506. *Patellina corrugata*, Williamson. Pl. VII, fig. 5.

Patellina corrugata, Williamson, 1858, RFGB. p. 46, pl. iii, figs. 86–89.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 686.

Stations 2–6, 26, 27, 31, 38, 45–48, 50, 53–55 (+ D.).

Universally distributed except in the deep-water area. Typical, and often abundant, the finest series in the Antarctic area, particularly at Stations 31, 38, 45 and 53. The Antarctic specimens are, as a rule, free from any very high conical forms, such as occur in the N.Z. area, notably at Stations 2, 3 and 6. At Station 6 a single fossil specimen.

At Station 47 a very interesting specimen exhibiting the formation of young shells. The parent is of normal megalospheric type. Viewed from underneath, it is seen that the whole of the chambers except the outer annular ring of chamberlets have been absorbed, and the cavity is occupied by a sub-globular mass consisting of a large number of minute individuals, probably thirty or forty at least, each consisting of part of the initial spiral of the adult shell. This mass of young projects considerably beyond the flat base. There is no sign of any other adult shell having been attached ("plastogamy") as figured by Schaudinn (S., 1895, PF., p. 181, fig. O, p. 185).

507. *Patellina corrugata*, var. *annularis* (Parker and Jones).

Orbitolina annularis, Parker and Jones, 1859, etc., NF. 1860 (vol. vi.), pp. 30, 31.
Patellina corrugata, Carpenter, Parker and Jones, 1862, ISF. p. 230, pl. xiii, figs. 16, 17.
,, ,, Chapman, 1907. RFV. p. 134, pl. x, fig. 7.

Stations 2, 3.

At these N.Z. Stations a few individuals referable to the very distinctive multi-annular form which is such a prominent feature of the S. Australian shore-sands. In its most advanced development, as found in such sands, the variety is very striking and hardly identifiable with the normal *P. corrugata*. The N.Z. specimens are smaller and much less distinctive, and at the same Stations other specimens, representing transition-stages between this variety and the depressed scale-like form of the type, occur.

CYMBALOPORA, Hagenow.

508. *Cymbalopora poeyi* (d'Orbigny).

Rotalia squammosa, d'Orbigny, 1826, TMC. p. 272, No. 8.
Cymbalopora poeyi, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 687.

Stations 2, 5, 6.

A single very high-domed specimen of the original type of *Rotalia squammosa*,

d'Orb., at Station 2, but with only three visible chambers at the base, instead of six, as in d'Orbigny's figure. At Stations 5 and 6 a few individuals of the depressed *C. poeyi* type, rather pauperate.

509. *Cymbalopora bulloides* (d'Orbigny).

Rosalina bulloides, d'Orbigny, 1839, FC. p. 98, pl. iii, figs. 2–5.
Cymbalopora bulloides, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 688.

Stations 5, 6.

A single specimen at Station 5, and two at Station 6, all large and belonging to the type with depressed acervuline chambers.

DISCORBINA, Parker and Jones.

510. *Discorbina cora* (d'Orbigny).

Rosalina cora, d'Orbigny, 1839, FAM. p. 45, pl. vi, figs. 19–21.
Discorbina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 690.

Station 2.

Fine fossil specimens only.

511. *Discorbina nitida* (Williamson).

Rotalina nitida, Williamson, 1858, RFGB. p. 54, pl. iv, figs. 106–108.
Discorbina nitida, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 691.

Stations 2–9, 11 (+ R. d. J.).

Very good examples at Stations 3, 5, 6. Budding specimens at Station 6. Fossils at Stations 2 and 6.

512. *Discorbina millettii*, Wright.

Discorbina millettii, Wright, 1910–11, ECM. p. 13, pl. ii, figs. 14–17.
,, ,, Heron-Allen and Earland, 1916, FWS. p. 270.

Station 9.

A single typical specimen.

513. *Discorbina praegeri*, Heron-Allen and Earland.

Discorbina praegeri, Heron-Allen and Earland, 1913, CI. p. 122, pl. x, figs. 8–10; 1914, etc., FKA. 1915, p. 692; 1916, FWS. p. 270; 1916, FSC. p. 50.

Stations 2–6, 11, 32, 40.

Sparingly distributed, but fairly frequent and typical at Station 6.

514. *Discorbina isabelleana* (d'Orbigny).

Rosalina isabelleana, d'Orbigny, 1839, FAM. p. 43, pl. vi, figs. 10–12.
Discorbina ,, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 692.

Stations 2, 4–6.

Rare, best at Stations 5 and 6. A budding ("plastogamic") specimen at the latter Station.

515. *Discorbina vilardeboana* (d'Orbigny).

Rosalina vilardeboana, d'Orbigny, 1839, FAM. p. 44, pl. vi, figs. 13–15.
Discorbina ,, Heron-Allen and Earland, 1914, etc. FKA. 1915, p. 692.

Stations 4–6, 27 (+ R. d. J.).

Poor specimens, hardly typical, the best at Station 6.

[Arenaceous isomorph, *Trochammina squamata*, J. & P. (?), and *Valvulina fusca*, (Will.).]

516. *Discorbina peruviana* (d'Orbigny).

Rosalina peruviana, d'Orbigny, 1839, FAM, p. 41, pl. i, figs. 12–14.
Discorbina ,, Heron-Allen and Earland, 1913, CI. p. 122, pl. xi, figs. 1–3.

Stations 6, 27 (+ R. d. J.).

The best at Station 27, where it is fairly frequent.

517. *Discorbina rosacea* (d'Orbigny).

Rotalina rosacea, d'Orbigny, 1826, TMC. p. 273, no. 15, Modèle no. 39.
Discorbina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 692.

Stations 1–6, 8, 10, 11, 16, 26, 45, 50, 53, 55 (+ R. d. J., D.).

Universally distributed, the best at Stations 4, 6, and 26. A sessile specimen at Station 6. At Stations 45 and 50 a tendency to the formation of chitinous shells.

518. *Discorbina baccata*, Heron-Allen and Earland.

Discorbina baccata, Heron-Allen and Earland, 1913, CI. p. 124, pl. xii, figs. 1–3; 1916, FWS. p. 271; 1916, FSC. p. 50.

Stations 2, 3, 5.

Recent at Station 5, fossils at Stations 2 and 3. Rare.

519. *Discorbina turbo* (d'Orbigny).

Rotalia (*Trochulina*) *turbo*, d'Orbigny, 1826, TMC. p. 274, no. 39, Modèle no. 73.
Discorbina turbo, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 693.

Stations 2, 3, 5, 6, 26, 53 (+ R. d. J.).

The best at Stations 5 and 6. A budding specimen at Station 6. Fossils at Stations 2 and 3. The most southerly specimen is rather depressed, being intermediate between *D. turbo* and *D. rosacea*.

520. *Discorbina orbicularis* (Terquem).

Rosalina orbicularis, Terquem, 1875, etc., APD. 1876, p. 75, pl. ix, fig. 4.
Discorbina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915 p. 693.

Stations 2, 3, 5, 6.

Confined to the N.Z. area, the best at Station 6. At Stations 1 and 2 the specimens are all strongly limbate.

521. *Discorbina mediterranensis* (d'Orbigny).

Rosalina mediterranensis, d'Orbigny, 1826, TMC. p. 271, no. 2.
Discorbina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 693.

Stations 2–6, 38 (+ K. I.).

Rare in the N.Z. area, but good specimens at Stations 5 and 6, less typical elsewhere. Fossils at Stations 3 and 6. Excellent, and fairly frequent at Station 38.

522. *Discorbina irregularis*, Rhumbler.

Discorbina irregularis, Rhumbler, 1906, FLC, p. 70, pl. v, figs. 57, 58.
,, ,, Heron-Allen and Earland, 1913, CI. p. 120, pl. x, figs. 2–4.

Station 6.

A single specimen of this wild-growing *D. globularis*.

523. *Discorbina globularis* (d'Orbigny).

Rosalina globularis, d'Orbigny, 1826, TMC. p. 271, pl. xiii, figs. 1–4, Modèle no. 69.
Discorbina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 694, pl. li, figs. 36–39.

Stations 2–8, 13, 26, 31, 38, 45–48, 53–55 (+R. d. J., D.).

Universally distributed, but most abundantly and best developed in the extreme south. The specimens from the Stations south of Station 38 are all large, usually of the high-domed irregular type. Abundant both in the free and sessile conditions. At Station 46 a specimen was found living sessile on a small Pycnogonid. Most of the Antarctic specimens are thin-walled, with a tendency to depauperation and chitinous growth. The most noticeable record is that of a single small, thin-walled but quite typical, individual at Station 13 in a depth of 3,003 fms.; with the exception of a few starved Miliolids, it represents the only benthic calcareous organisms found in that gathering, and the depth is enormously beyond any previous record for the species. In the N.Z. area the specimens are less abundant and generally poorly developed, except at Stations 5 and 6. Fossil specimens at several N.Z. Stations and, as with many other species, the fossils are noticeably larger and more strongly developed than the recent individuals.

524. *Discorbina polyrraphes* (Reuss).

Rotalina polyrraphes, Reuss, 1845–6, VBK. pt. i, p. 35, pl. xii, fig. 18.
Discorbina ,, Heron-Allen and Earland, 1916, FWS. p. 272.
,, ,, Wright, 1910–11, BCNI. p. 4, pl. i, fig. 3.

Station 6.

A few typical specimens. This is a species liable to be overlooked on account of its minute size.

525. *Discorbina obtusa* (d'Orbigny).

Rosalina obtusa, d'Orbigny, 1846, FFV. p. 179, pl. xi, figs. 4–6.
Discorbis ,, Cushman, 1910, etc., FNP. 1915, p. 13, fig. 12.

Station 6 (+ R. d. J.).

A few small specimens.

526. *Discorbina valvulata* (d'Orbigny).

Rosalina valvulata, d'Orbigny, 1826, TMC. p. 271, no. 4.
Discorbina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 695.

Station 6.

A far from typical specimen.

527. *Discorbina saulcii* (d'Orbigny).

Rosalina saulcii, d'Orbigny, 1839, FAM. p. 42, pl. ii, figs. 9–11.
Discorbina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 696; 1908, etc., SB. 1909, p. 444.

Station 6.

One small and doubtful specimen.

528. *Discorbina chasteri*, Heron-Allen and Earland.

Discorbina minutissima, Chaster, 1892, FS. p. 65, pl. i, fig. 15.
,, *chasteri*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 697.

Stations 27, 36, 38, 53, 55.

Confined to the Antarctic area and reaching exceptional development at Station 38. Several typical specimens at Station 36 (2,216 fms.). The occurrence of this curious but distinctive little form, so far away from its original locality in British seas, and in such deep water, is noteworthy. No spinous examples (our var. *bispinosa*, H.-A. & E. 1913, CI. p. 129, pl. xiii, fig. 4) occur, although the variety is recorded by Sidebottom from the East Coast of Australia, in 465 fms. (S. 1918, FECA. p. 256, pl. vi, figs. 18, 19), the type being absent in that locality.

529. *Discorbina rugosa* (d'Orbigny).

Rosalina rugosa, d'Orbigny, 1839, FAM. p. 42, pl. ii, figs. 12–14.
Discorbina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 697.

Station 6 (+ R. d. J.).

A few specimens of a rather compressed type.

[Arenaceous isomorph, *Trochammina inflata*, (Mont.).]

530. *Discorbina bertheloti* (d'Orbigny).

Rosalina bertheloti, d'Orbigny, 1839, FIC. p. 135, pl. i, figs. 28–30.
Discorbis ,, Cushman, 1910, etc., FNP. 1915, p. 20, pl. vii, fig. 3.

Stations 3, 4, 6, 8, 31 (+ R. d. J.).

Confined to the N.Z. area, save for a single weak example at Station 31. Very fine series of specimens at Station 6, including both sessile and "plastogamic" or budding individuals. Fossil at Station 3.

531. *Discorbina bertheloti*, var. *baconica*, Hantken.

Discorbina baconica, Hantken, 1875, CSS. p. 76, pl. x, figs. 3 *a*, *b*.
Discorbina bertheloti, var. *baconica*, Heron-Allen and Earland, 1916, FSC. p. 50, pl. viii, figs. 10–12.

Stations 2–6 (+ R. d. J.).

Confined to the N.Z. area. The best examples at Station 6, including sessile individuals, and specimens characterized by excessive limbation of the sutural lines. Similar specimens at Station 5. Fossils at Station 6.

532. *Discorbina rarescens*, Brady.

Discorbina rarescens, Brady, 1884, FC. p. 651, pl. xc, figs. 2, 3, and ? 4.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 700.

Station 6.

Specimens exhibiting wide variation in the development of the carina, and in the degree of inflation of the chambers. Sometimes so flat as to be almost scale-like. A sessile individual also observed.

533. *Discorbina pustulata*, Heron-Allen and Earland.

Discorbina pustulata, Heron-Allen and Earland, 1913, CI. p. 129, pl. xii, figs. 5–7; 1914, etc. FKA. 1915, p. 701, pl. lii, figs. 24–26; 1916, FWS. p. 273; 1916, FSC. p. 50.

Stations 2, 6.

Excellent examples at Station 2. Those from Station 6 apparently fossil.

534. *Discorbina parisiensis* (d'Orbigny).

Rosalina parisiensis, d'Orbigny, 1826, TMC. p. 271, Modèle no. 38.
Discorbina „ Heron-Allen and Earland, 1914, etc., FKA. 915, p. 701.

Stations 2, 38, 47, 50, 55 (+ K. I.).

Except for a somewhat doubtful fossil at Station 2 the species is confined to the Antarctic area, where it is fairly frequent at some Stations, but never attains the enormous dimensions that it does at some Arctic Stations which we have examined, or in the Kerguelen Island material referred to in our Appendix B.

535. *Discorbina opercularis* (d'Orbigny).

Rosalina opercularis, d'Orbigny, 1826, TMC. p. 271, no. 7.
Discorbis „ Cushman, 1910, etc., FNP. 1915, p. 18, pl. xi, fig. 3.

Stations 2–6, 7.

Very fine examples at Stations 5 and 6. Fossils at Stations 2 and 6 and "plastogamic" at Station 3.

536. *Discorbina pileolus* (d'Orbigny).

Valvulina pileolus, d'Orbigny, 1839, FAM. p. 47, pl. i, figs. 15–17.
Discorbina ,, Brady, 1884, FC. p. 649, pl. lxxxix, figs. 2–4.

Stations 1–6.

Common everywhere, fossils at Stations 2, 3, and 6. This is perhaps the species of *Discorbina* in which budding (or plastogamy) occurs most abundantly. At every Station except Station 4, such pairs occur in profusion, and in every condition from the actual paired shells to disunited specimens in which the whole of the internal septa have been absorbed. There is, in such series, a complete gradation of size in the budded shell from very elementary individuals, to fully-formed tests, and there is a corresponding difference in the proportions of the individuals, a low-domed specimen being often budded from an abnormally high-domed one. (*See* H.-A. 1915, RPF. p. 246, pl. xv, fig. 27.)

537. *Discorbina patelliformis*, Brady.

Discorbina patelliformis, Brady, 1884, FC. p. 647, pl. lxxxviii, fig. 3, pl. lxxxix, fig, 1.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 703, pl. lii, fig. 32.

Stations 1–3, 5, 6.

The best at Station 1. Fossils at Stations 2, 3 and 6. Rare everywhere.

538. *Discorbina calcarata*, sp. nov. Pl. VII, figs. 12–16.

Stations 2, 3, 5, 6.

Test circular, dome-shaped, consisting of two to three convolutions of chambers, six to eight chambers in each convolution. Sutural lines thick, but not limbate, curving. From the extremity of each sutural line extends a solid spine of very variable dimensions; sometimes a mere papillation on the marginal edge of the shell, occasionally strong and markedly projecting. Base flat, excavated in the centre, beaded in radiating lines. Surface matt to rough. Apical chamber usually smooth and polished.

Dimensions:—Width, ·20–·30 mm.; height, ·20 mm.

Resembles *D. imperatoria* (d'Orb.), as figured by Sidebottom (S. 1904, etc., RFD. 1908, p. 13, pl. v, figs. 1, 2) but is less pointed at the apex, flat instead of concave at the base, and more variable in the character of its spines. The Delos specimens have straight sutural lines.

Confined to the N.Z. area. At Stations 2 and 3 the spinous development is much more marked than at Stations 5 and 6. Many fossils, but, owing to the nature of the shell-surface, these are not easy to discriminate.

539. *Discorbina harmeri*, sp. nov. Pl. VII, figs. 9–11.

Stations 2–6, 8.

Test circular, more or less highly domed, rounded at the apex. Very thick-

walled, very finely striate, with lines running radially from the apex to the periphery. Marginal edge acute, with a tendency at Stations 5 and 6 to become carinate. Base, flat with a small central umbilicus studded with beads. About four convolutions of long curving chambers, six to eight in the last convolution. Viewed as an opaque object the dome-shaped glassy shell has a white spiral running round it from apex to base, which, under higher magnification, becomes resolved into a line of tubules extending through the thick wall of the chambers.

Dimensions :—Width, ·32–·37 mm. ; height, ·15 mm.

This is one of the most distinctive N.Z. species, and is frequent at several Stations, especially Stations 5 and 6. Budding (" plastogamic "), and a few fossil individuals at Stations 5 and 6. It appears to be most nearly allied to *D. pileolus*, but has many distinctive characteristics.

540. *Discorbina tabernacularis*, Brady.

Discorbina tabernacularis, Brady, 1879, etc., RRC. 1881, p. 65 ; 1884, FC. p. 648, pl. lxxxix, figs. 5–7.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 704.

Stations 2, 3, 6.

All fossils.

541. *Discorbina disparilis*, sp. nov. Pl. VII, figs. 20–22.

Station 2.

Test compressed, consisting of about two convolutions, eight chambers in the final convolution rapidly increasing in size. Surface coarsely tuberculate. Sutures strongly limbate on the superior side, the sutures and the tuberculation rendering the septation very indistinct. Marginal edge produced into a thick rounded carina. Inferior surface slightly concave, smooth. Sutural lines very indistinct.

Dimensions :—Length, ·38–·42 mm. ; maximum breadth, ·30 mm.

The above description is the best possible for a very obscure form represented by two specimens at Station 2. It is difficult to diagnose, owing to the obscuration of all the earlier structure by the tuberculation of the superior surface, and by the fact that the inferior surface, which is plane, is thick-walled and opaque. The number and shape of the internal chambers can, however, be made out by wetting the inferior surface. Its affinities are rather obscure; it may belong to the *D. biconcava* group, but its nearest ally is clearly *D. involuta*, Sidebottom (S., 1918, FECA. p. 255, pl. vi, 15–17), which it closely resembles in its superior and inferior aspects, but from which it differs in the absence of the subsidiary septa which in Sidebottom's specimens subdivide the internal cavity of each chamber. These, however, may be merely structural developments due to the deeper water from which his specimens were obtained.

542. *Discorbina biconcava*, Parker and Jones.

Discorbina biconcava, Carpenter, Parker and Jones, 1862, ISF. p. 201, fig. 32 *g*.
,, ,, Brady, 1884, FC. p. 653, pl. xci, figs. 2, 3.

Stations 2–6.

Very rare and far from typical. Fossils at Stations 3 and 6.

543. *Discorbina wilsoni*, sp. nov. Pl. VII, figs. 17–19.

Stations 23, 38, 48.

Test free, oval in outline, highly convex on the superior, flat on the inferior surface, but sloping inwards to the umbilical apertural opening. Consisting of about two convolutions of chambers, rapidly increasing in size, slightly swollen, separated by limbate sutures rising into sharp ridges, and forming a sharp narrow edge to the shell. Surface of the chambers between the sutural ridges rough, with beads, forming in some instances transverse costae. Colour opaque dull yellowish-white on the superior side, clear and glassy on the inferior, where the sutural lines are obscure. Aperture, a depression on the inferior face of the terminal chamber, bordered by radiating lines, leading down to a depression furnished with the normal discorbine tooth.

Dimensions :—Length, ·32–·37 mm.; breadth, ·27–·32 mm.; height, ·13 mm.

A few specimens only at each Station. They have considerable resemblance as regards the superior face to Brady's *D. ventricosa* (B., 1884, FC. p. 654, pl. xci, fig. 7), but differ entirely from that species in the character of the underside, and of their decoration. Karrer's *Pulvinulina erinacea* (Karrer, 1868, MFKB. p. 187, pl. v, fig. 6), which is an isomorph of *D. ventricosa*, has also a certain resemblance to our species, which may probably be regarded as an isomorph of *P. lateralis*.

544. *Discorbina pulvinoides*, Cushman.

Discorbis pulvinoides, Cushman, 1910, etc., FNP. 1915, p. 23, pl. vi, fig. 3.

Stations 1, 2, 6, 27.

We attribute our specimens to Cushman's species, but with some reservation. His figure is unsatisfactory as it shows no edge-view; he appears to have founded the species upon a single specimen, and does not refer to the peculiar secondary chambers which are indicated in our specimens, especially in the large and typical example from Station 6. These secondary chambers clearly indicate the close relationship of our specimens to *D. lingulata*.

545. *Discorbina lingulata*, Burrows and Holland.

Discorbina lingulata, Burrows and Holland in J. P. & B., 1866, etc., MFC. 1896, p. 297, pl. vii, figs. 33, *a–c*.

Stations 1, 2, 8, 11.

Very fine examples at Stations 1 and 2, but extremely rare. In the deeper water the specimens become depauperate, but retain their characteristic structure.

546. *Discorbina lingulata*, var. *unguiculata*, Sidebottom.

Discorbina lingulata, var. *unguiculata*, Sidebottom, 1918, FECA. p. 255, pl. vi, figs. 12–14.

Stations 2, 3.

At Station 2 a good many examples of this strongly limbate variety. At Station 3 a few which are almost certainly fossils. The only previous record is from the E. coast of Australia (465 fms.).

PLANORBULINA, d'Orbigny.

547. *Planorbulina mediterranensis*, d'Orbigny.

Planorbulina mediterranensis, d'Orbigny, 1826, TMC. p. 280, pl. xiv, figs. 4–6, Modèle no. 79.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 705.

Stations 3, 21.

A doubtful specimen at Station 3, and a small but unquestionable specimen from Station 21, in 1,714 fms., probably the deepest record hitherto.

548. *Planorbulina acervalis*, Brady.

Planorbulina acervalis, Brady, 1884, FC. p. 657, pl. xcii, fig. 4.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 705.

Station 6.

A single good specimen.

TRUNCATULINA, d'Orbigny.

549. *Truncatulina refulgens* (Montfort). Pl. VII, figs. 23, 28.

Cibicides refulgens, Montfort, 1808–10, CS. vol. i, p. 122, 31^{me} genre.
Truncatulina refulgens, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 707.

Stations 1–6, 12, 18, 26–28, 30, 36, 38, 45–50, 53–55 (+ K. I., R. d. J., D.).

Universally distributed, reaching its maximum development in the extreme S., where it attaches itself to every solid organic and inorganic object. The Polyzoa notable at Station 50 are covered with sessile individuals. These sessile specimens are, as a rule, surrounded by a thin layer of mud, from which extend tubes at irregular intervals all round the shell, the object evidently being to convey the protoplasm, under protection, to some distance from the shell. Such tube-bearing specimens are also found in quantity at Station 27. Here, as at many other Stations, where the type is abundant, many of the specimens are seen to be riddled with small circular holes, especially as to the terminal chambers. Whether these are the borings of a parasite, or in the nature of

subsidiary apertures, there is no evidence to show—probably the former. In the NZ. area the species is much less abundant and less strongly developed than in the Antarctic, but good specimens are found at several Stations, notably Station 6, where also a very handsome cultrate, high-domed type occurs with a thick, glassy shell. At Station 48 occurred a large specimen, ·80 mm. in diameter, which we figure (pl. VII, fig. 24), with the terminal chamber broken and revealing a number of viviparous young in the cavity.

550. *Truncatulina lobatula* (Walker and Jacob).

Nautilus lobatulus, Walker and Jacob, 1798, AEM. p. 642, pl. xiv, fig. 36.
Truncatulina lobatula, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 706.

Stations 1–6, 8–12, 16–19, 23, 26, 27, 29, 31, 38, 45, 47, 48, 50, 53 (+ K. I., R. d. J., D.).

Universally distributed, and, except in the deep water, abundant. Every possible variation, including sessile and encrusted specimens at Station 6, one small individual having become encrusted within the arms of a large Tetractinellid sponge-spicule. At a few Stations (8, 9, 26, 29, 31 and 38) the species is characterized by its minute size, for no apparent reason, otherwise the species is constant in maximum size to the farthest South. Some of the best and most strongly built specimens are from Stations between 45 and 50. At Station 11 a specimen with an extremely minute individual encrusted upon the centre of the flat side.

[Arenaceous isomorph, *Nubecularia lucifuga*, Defr., see note to No. 4.]

551. *Truncatulina lobatula*, var. *arenacea*, nov. Pl. VII, figs. 32–35.

Stations 26, 45.

At Station 26 small neat arenaceous isomorphs, comparable in size and development with the hyaline type, as occurring at this Station. One sessile, and one free individual. The test is neatly constructed of fine sand-grains and ferruginous cement. One less typical example at Station 45.

The size is very variable; a typical specimen was ·40 mm. long and ·30 mm. broad.

552. *Truncatulina variabilis*, d'Orbigny.

Truncatulina variabilis, d'Orbigny, 1826, TMC. p. 279, no. 8.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 706.

Stations 2–4, 6, 12, 16, 18, 19, 50, 55 (+ R. d. J., D.).

Abundant down to Station 6. At the other Stations represented, as a rule, by single individuals presenting no particular features. At Station 19 very thin and outspread, at Station 50 an individual of a very massive and thick-walled type, probably derived from *T. refulgens* rather than from *T. lobatula*. The N.Z. specimens are more noteworthy; it occurs both recent and fossil at Stations 2, 3 and 6, and the fossil specimens are perhaps the most interesting series; they

include every conceivable monstrosity, and a number of specimens simulating the structure of widely-separated genera. Many individuals with regularly textularian chambers, others proceeding from textularian to bigenerine, others with acervuline masses. At Stations 2 and 3, in addition to the type of usual truncatuline texture, a form occurs abundantly, both sessile and attached, in which the shell-wall is very finely tubulate, thick and glistening. This type does not occur elsewhere in the gatherings.

[Arenaceous isomorph, *Haplophragmium canariense*, var. *variabilis*, H.-A. & E.]

553. *Truncatulina tenuimargo*, Brady.

Truncatulina tenuimargo, Brady, 1884, FC. p. 662, pl. xciii, figs. 2, 3.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 707.

Stations 2, 3, 6, 8, 12.

A few typical specimens of the keeled type represented by Brady's fig. 3 occur. Fossil specimens at Stations 2, 3, and 6.

554. *Truncatulina tenuimargo*, var. *alto-camerata*, nov. Pl. VII, fig. 24–27.

Truncatulina tenuimargo, Brady, 1884, FC. p. 662, pl. xciii, fig. 2.
,, ,, Sidebottom, 1918, FECA. p. 257, pl. vi, figs. 20, 21.

Stations 2, 3, 6, 7, 11, 12.

The extraordinary variety adumbrated by Brady in his Fig. 2, and figured by Sidebottom (*ut supra*) occurs generally over the N.Z. area, though specimens are rare. Brady's figure represents a transition form between carinate *T. lobatula.* and the high conical-chambered Sidebottom figure, and such intermediate specimens, representing all stages of transition, occur at Stations 3 and 6. The variety reaches its maximum development at Station 2, with individuals having as many as eight high conical chambers to the whorl. At Station 6, where it was most frequent, the specimens are much smaller and the cone is less elevated. Beyond Station 6 it gradually dies out, becoming very rare and smaller in the deeper water, and at Station 12 the cone is hardly more prominent than in Brady's figure. All the specimens at Station 7 were dead and discoloured shells. At Station 3 an individual, intermediate between the extreme types, occurs with pustules of solid shell-matter on the low cones of the chambers. Fossil and recent at Stations 3 and 6; the fossil specimens and the recent are identical. Seguenza figures and describes a form as *Discorbina plano-convexa*, having somewhat similar characteristics, but referable by its aperture to *Discorbina*, and it may be regarded as an isomorph (S. 1882, CMIM. p. 199, pl. xxi, fig. 2a, b). A somewhat similar form is described and figured by Schwager (S. 1883, ELW. p. 126, pl. xxix, fig. 14) under the name *Truncatulina colligera*, but the chambers are less dome-shaped and prominent.

The size varies greatly, attaining a length of ·70 mm. and a breadth of ·50 mm., with a maximum height of ·30 mm. in the final chamber.

555. *Truncatulina wuellerstorfi* (Schwager).

Anomalina wuellerstorfi, Schwager, 1866, FKN. p. 258, pl. vii, fig. 105.
„ „ Cushman, 1910, etc., FNP. 1915, p. 34, pl. xii, fig. 3.

Stations 2, 3, 6–12, 17–20, 22, 32, 48.

Generally distributed as far as Station 32. Very abundant at Stations 3, 10, 11. At Station 3 the specimens are very complanate, with a tendency to sinuous chambers. At Stations 17 and 18, where they are small, the type is high-domed.

556. *Truncatulina haidingerii* (d'Orbigny).

Rotalina haidingerii, d'Orbigny, 1846, FFV. p 154, pl. viii, figs. 7–9.
Truncatulina haidingerii, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 708.

Stations 1–6, 8, 10–12, 50, 55.

Generally distributed in the N.Z. area, and presenting the usual wide range of variation. Cultrate forms at Stations 2, 3 and 6. Glauconitic casts at Station 6. Fossils at Stations 2 and 6. Outside the N.Z. area the form only occurs farthest South, where they are fairly normal and moderately thick-shelled.

557. *Truncatulina akneriana* (d'Orbigny).

Rosalina akneriana, d'Orbigny, 1846, FFV. p. 156, pl. viii, figs. 13–15.
Truncatulina akneriana, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 709.

Stations 1–3, 6–8, 17, 20, 26, 36, 38.

Generally distributed as far as Station 38, where the finest specimens were found.

[Arenaceous isomorph, *Haplophragmium truncatuliniforme*, Chap. (C. 1895, FAS, p. 16, pl. i, fig. 2).]

558. *Truncatulina ungeriana* (d'Orbigny).

Rotalina ungeriana, d'Orbigny, 1846, FFV. p. 157, pl. viii, figs. 16–18.
Truncatulina ungeriana, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 708.

Stations 1–3, 5–12, 16–18, 22, 31, 32, 36, 38, 49, 50.

Almost universally distributed, the best in the N.Z. area at Stations 3 and 6, very small at Stations 9 and 10. The Antarctic specimens do not present any special features. At Station 2 a broken specimen exhibiting the chitinous lining to the chambers.

559. *Truncatulina robertsoniana*, Brady.

Truncatulina robertsoniana, Brady, 1879, etc., RRC. 1881, p. 65; 1884, FC. p. 664, pl. xcv, fig. 4.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 708.

Stations 2, 3, 5, 6, 8, 9, 11, 27, 29.

In the N.Z. area good and typical specimens at Stations 2, 3, and 6,

especially at the last. At Stations 8, 9, and 11 the specimens are extremely minute, hyaline and colourless, but preserving the characteristic configuration of the type. At Station 27 the normal type occurs, but very small, and at Station 29 it becomes even more pauperate and semi-chitinous.

560. *Truncatulina tenera*, Brady.

Truncatulina tenera, Brady, 1884, FC. p. 665, pl. xcv, fig. 11 *a–c*.
„ „ Heron-Allen and Earland, 1916, FWS. p. 275, pl. xlii, figs. 31–33.

Stations 7, 8, 10–12, 14, 17–19, 23, 41 (+ T. d. F.).

Sparingly represented, but very good and typical.

561. *Truncatulina dutemplei* (d'Orbigny).

Rotalina dutemplei, d'Orbigny, 1846, FFV. p. 157, pl. viii, figs. 19–21.
Truncatulina „ Cushman, 1910 etc., FNP. 1915, p. 37, pl. xv, fig. 2.

Station 22 (+ T. d. F., D.).

A single specimen.

562. *Truncatulina tumidula*, Brady.

Truncatulina tumidula, Brady, 1884, FC. p. 666, pl. xcv, figs. 8, *a–d*.
„ „ Cushman, 1910, etc., FNP. 1915, p. 38, pl. xv, fig. 3.

Stations 2, 6, 10, 11, 16, 17, 18, 20, 29–31, 36 (+ D.).

Generally distributed as far as Station 36. The number of specimens few, but the form is very apt to be overlooked. Most prominent at Stations 10 and 31 ; chitinous pauperate specimens at the latter Station.

563. *Truncatulina pygmaea* (Hantken).

Pulvinulina pygmaca, Hantken, 1875, CSS. p. 78, pl. x, fig. 8 (*Truncatulina* in plate).
Truncatulina „ Cushman, 1910, etc., FNP. 1915, p. 38, fig. 41.

Stations 7, 9, 10, 18, 20 26, 27, 31 (+ T. d. F.).

The best at Station 18. The specimens are all typical.

564. *Truncatulina praecincta* (Karrer).

Rotalia praccincta, Karrer, 1868, MFKB. p. 189, pl. v, fig. 7.
Truncatulina praccincta, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 709.

Stations 2, 3, 6.

Few in number and not very typical.

565. *Truncatulina culter* (Parker and Jones).

Planorbulina culter, Parker and Jones, 1865, NAAF. p. 421, pl. xix, fig. 1.
Truncatulina „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 709.

Stations 2, 3, 6, 7.

Rare but very good specimens, the best at Stations 2 and 3. Fossils at Station 6.

566. *Truncatulina reticulata* (Czjzek).

Rotalina reticulata, Czjzek, 1848, FWB. p. 145, pl. xiii, figs. 7–9.
Truncatulina reticulata, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 710.

Stations 1, 6 (+ R. d. J.).

Very rare at Station 1; exceptionally fine and large specimens at Station 6.

ANOMALINA, Parker and Jones.

567. *Anomalina polymorpha*, Costa.

Anomalina polymorpha, Costa, 1853, etc., PRN. 1856, p. 252, pl. xxi, figs. 7–9.
„ „ Heron-Allen and Earland, 1915, FKA. p. 712, pl. liii, figs. 2–5.

Stations 2, 3, 6.

Abundant at Stations 2 and 3, and rare at Station 6. As its name implies, this species is exceedingly variable, and the series from Stations 2 and 3 cover practically the whole gamut of variations. The specimens range between thin regular spineless forms, thicker spineless forms practically inseparable from *A. coronata*, normal spinous individuals in which the regular development of the shell is not lost, and wild-growing specimens with abnormal development of the spines and sometimes with accessory chambers. Even the development of the spines does not follow any fixed line, for, in some instances, they are developed from the ends of the strongly limbate sutures and are formed of solid shell-matter, while in others they are developed from the wall of the chambers, occasionally with an aperture at the tip. The development of these particular forms may be observed in the case of shells which have lived sessile upon large sponge-spicules. The surface available for attachment being small, relatively to the size of the organism, an extension of the chamber is seen to be launched out in each direction in the axis of the spicule. Similar specimens have been admirably figured by Chapman (C. 1901, FLC. p. 392, pl. 1).

568. *Anomalina coronata*, Parker and Jones.

Anomalina coronata, Parker and Jones, 1857, FCN. p. 294, pl. x, figs. 15, 16.
„ „ Cushman, 1910, etc., FNP. 1915, p. 47, pl. xviii, fig. 5.

Stations 3, 6.

Extremely rare. The scarcity of this species, as compared with the abundance of *A. polymorpha* occurring at the same Stations, is very noticeable.

569. *Anomalina ariminensis*, d'Orbigny.

Anomalina ariminensis, d'Orbigny, 1826, TMC. p. 282, no. 2, pl. xiv, figs. 1–3.
„ „ Cushman, 1910, etc., FNP. 1915, p. 44, pl. xix, fig. 1 (text fig. 49).

Stations 2, 3, 6, 10, 11.

Confined to the N.Z. area. Frequent and variable at Station 6. Rare else-

where. At Station 6 some of the specimens closely approach Sidebottom's *A. sinuosa*, owing to the strong limbation of the sutural lines on the upper surface, but they are altogether more strongly built, and show little indication of the carinate periphery characterizing Sidebottom's species (S., 1918, FECA, p. 258, pl. vi, figs. 22–25). Some of these limbate specimens are granular on the surface between the limbations; there is a tendency in the later chambers to thin out. The limbate form occurs also at Station 10, but the specimens are very small. Fossil examples occur at Stations 2, 3 and 6, exclusively fossil at Station 3, all large and typical.

570. *Anomalina sinuosa*, Sidebottom.

Anomalina sinuosa, Sidebottom, 1918, FECA. p. 258, pl. vi, figs. 22–25.

Stations 11, 12.

Extremely rare. The specimens from Station 11 typical, but weak; at Station 12, limbation strongly developed, but with weak peripheral edge.

CARPENTERIA, Gray.

571. *Carpenteria proteiformis*, Goës.

Carpenteria balaniformis, var. *proteiformis*, Goës, 1882, RRCS. p. 94, pl. vi, figs. 208–214, pl. vii, figs. 215–219.
„ *proteiformis*, Cushman, 1910, etc., FNP. 1915 p. 49, pl. xx, fig. 2; pl. xxi, fig. 1.

Station 6.

Several specimens of a thick-walled type, studded with solid beads of clear shell-matter similar to Chapman's figure. (Proc. Roy. Soc. Vict. vol. xxvi. 1913, pl. xvi, fig. 7.)

PULVINULINA, Parker and Jones.

572. *Pulvinulina repanda* (Fichtel and Moll).

Nautilus repandus, Fichtel and Moll, 1798, TM. p. 35, pl. iii, figs. *a–d*.
Pulvinulina repanda, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 713.

Stations 1, 2, 5–7, 26, 27.

Sparingly represented and small, except at Station 2, where it is very large and typical. Fossil only at Station 6.

573. *Pulvinulina repanda*, var. *concamerata* (Montagu).

Serpula concamerata, Montagu, 1803–8, TB. Suppl. p. 160 (*fide* Williamson, 1858, RFGB).
Pulvinulina (*repanda*, var.) *concamerata*, Cushman, 1910, etc., FNP. 1915, p. 52, pl. xxv, fig. 1.

Stations 2, 3, 6.

Fossils are frequent; the only recent example occurs at Station 6.

574. *Pulvinulina punctulata* (d'Orbigny).

Rotalia punctulata, d'Orbigny, 1826, TMC. p. 273, no. 25, Modèle no. 12.
Pulvinulina punctulata, Heron-Allen and Earland, 1916, CI. p. 134, pl. iv, figs. 20, 21.
,, ,, Cushman, 1910, etc., FNP. 1915, p. 52, pl. xxiv, fig. 1, text fig. 54.

Stations 6, 9.

One sessile specimen at Station 6, and a few small free individuals at Station 9.

575. *Pulvinulina concentrica*, Parker and Jones.

Pulvinulina concentrica, Parker and Jones (MS.), Brady, 1864, RFS. p. 470, pl. xlviii, fig. 14.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 714.

Stations 1–6.

This handsome species is abundant and very variable at the Stations. The largest individuals at Stations 1 and 2. At most of the Stations two distinct types occur, one depressed, with strongly limbate sutural lines, the other a high form with rather swollen chambers, so that the limbate sutures are sunk in sutural depressions. This swollen form is usually smaller than the others, and is covered all over with the characteristic orange-brown tint, which in the normal type is confined to a band round the edge of the chambers. This band may be wholly or partly missing. In a specimen at Station 6 the clear surface of the chambers was mottled with patches identical with the band-coloration, in another the marginal band is so strongly developed that the chamber-surface is reduced to a small square sunk in the middle. Fossils occur at Stations 2, 3 and 6, recognizable by the band-structure, the colour being destroyed.

576. *Pulvinulina auricula* (Fichtel and Moll).

Nautilus auricula, var. *a*, Fichtel and Moll, 1798, TM. p. 108, pl. xx, figs. *a*, *b*, *c*.
Pulvinulina auricula, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 714.

Stations 6 (+ R. d. J., D.).

A good many very fine specimens.

577. *Pulvinulina oblonga* (Williamson).

Nautilus auricula, var. *β*., Fichtel and Moll, 1798, TM. p. 108, pl. xx, figs. *d*, *e*, *f*.
Pulvinulina oblonga, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 714.

Stations 2, 6, 8, 9, 11, 16, 48, 53 (+ D.).

Not uncommon, the majority of the specimens small and thin-walled. Practically no difference between the specimens.

578. *Pulvinulina hauerii* (d'Orbigny).

Rotalina hauerii, d'Orbigny, 1846, FFV. p. 151, pl. vii, figs. 22–24.
Pulvinulina hauerii, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 715.

Stations 2, 7, 23.

Very rare. Single specimens at each Station.

579. *Pulvinulina brongniartii* (d'Orbigny).

Rotalia brongniartii, d'Orbigny, 1826, TMC. p. 273, no. 27.
Pulvinulina brongniartii, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 715.

Stations 2, 6, 11, 12, 31.

Rare, and far from typical, the best specimens, and also sessile examples, at Station 6.

580. *Pulvinulina haliotidea*, Heron-Allen and Earland.

Pulvinulina haliotidea, Heron-Allen and Earland, 1908, etc., SB. 1911, p. 338, pl. xi, figs. 6–11; 1913, CI. p. 136; 1916, FWS. p. 276.

Stations 2, 3, 6, 16.

One specimen from Station 16, recent and typical. The species occurs abundantly as a fossil at Stations 2, 3 and 6, and all the specimens are of much greater size than that from Station 16, or any of the European recent examples.

581. *Pulvinulina tumida*, Brady.

Pulvinulina menardii, var. *tumida*, Brady, 1877, FNB. p. 535.
„ *tumida*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 715.

Stations 3, 6 (+ K. I.).

Typical fossil examples at the N.Z. Stations.

582. *Pulvinulina canariensis* (d'Orbigny).

Rotalina canariensis, d'Orbigny, 1839, FIC. p. 130, pl. i, figs. 34–36.
Pulvinulina canariensis, Cushman, 1910, etc., FNP. 1915, p. 56, pl. xxiii, fig. 1.

Stations 1–3, 6–8, 10.

Confined to the N.Z. area, frequent and well developed.

583. *Pulvinulina patagonica* (d'Orbigny).

Rotalina patagonica, d'Orbigny, 1839, FAM. p. 36, pl. ii, figs. 6–8.
Pulvinulina patagonica, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 716.

Stations 2, 3, 7, 8, 9, 11 (+ R. d. J.).

Frequent in the N.Z. area. The specimens differ considerably in thickness of shell-wall.

584. *Pulvinulina patagonica*, var. *scitula*, Brady.

Pulvinulina scitula, Brady, 1882, FKE. p. 716.
„ „ Balkwill and Millett, 1884, FG. p. 85, pl. iv, fig. 12 (revision, p. 4)
„ *patagonica*, var. *scitula*, Heron-Allen and Earland, 1916, FSC. p. 51, pl. ix, figs. 2–5.

Stations 3, 6, 8.

The best at Stations 3; very rare. The tangled history of this variety has been fully dealt with by us as above.

585. *Pulvinulina crassa* (d'Orbigny).

Rotalina crassa, d'Orbigny, 1840, CBP. p. 32, pl. iii, figs. 7, 8.
Pulvinulina crassa, Cushman, 1910, etc., FNP. 1915, p. 58, pl. xxvii, fig. 1.

Stations 1–10, 32, 50 (+ T. d. F.).

Universally distributed in the N.Z. area, frequent and well-developed. Fossils at Stations 2 and 6. At the remaining Stations rare and small.

586. *Pulvinulina truncatulinoides* (d'Orbigny).

Rotalina truncatulinoides, d'Orbigny, 1839, FIC. p. 132, pl. ii, figs. 25–27.
„ *micheliniana*, d'Orbigny, 1840, CBP. p. 31, pl. iii, figs. 1–3.
Pulvinulina truncatulinoides, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 716.

Stations 1–3, 5–12, 14 (+ T. d. F., K. I.).

The confusion arising between d'Orbigny's two species has been treated from the bibliographical aspect by Millett (M., 1898, etc., FM., 1904, p. 500), but there is also a zoological side which, although a point of minor importance, may be worth referring to. The two species, although unquestionably zoologically identical, represent two different forms of divergent structure. *P. truncatulinoides*, described as a recent type, represents the thin-walled specimens with deeply sunk sutures and umbilical cavity. Such individuals are to be found in shallow-water gatherings wherever the species is recorded; the texture of the shell is always more or less hyaline, and the surface highly papillate under a high magnification. At greater depths the shell-wall thickens, the sutural depressions and the umbilical recess become filled with secondary shell-growth, and the test assumes the more rounded and smoother aspect of the fossil *P. micheliniana*. The difference between the two is a question of shell-thickening, and no doubt individuals of the one type pass in the process of advancing age into the other.

Our specimens illustrate this progress very well. In the shallower N.Z. Stations the open *truncatulinoides* type predominates, the specimens are large, handsome, thin-walled, and typical *truneatulinoides*. With the deeper water, especially at Stations 7–9, thick-walled specimens of the *micheliniana* type predominate. In many of them the sutural depressions and umbilical recess are entirely obliterated.

The best of the *truneatulinoides* type are at Stations 1–3 and 6, the best of the *micheliniana* type at 7–9, 12 and 14.

587. *Pulvinulina umbonata* (Reuss).

Rotalina umbonata, Reuss, 1851, FSUB. p. 75, pl. v, figs. 35, *a–c*.
Pulvinulina „ Cushman, 1910, etc., FNP. 1915, p. 60, pl. xxvii, fig. 2.

Stations 8–12, 16, 17, 36.

Rare; the best at Stations 10–12 and 17.

588. *Pulvinulina exigua*, Brady.

Pulvinulina exigua, Brady, 1884, FC. p. 696, pl. ciii, figs. 13, 14.
,, ,, Cushman, 1910, etc., FNP. 1915, p. 60, pl. xxiii, fig. 5.

Stations 6–10, 16–18, 22, 23, 26–28, 31, 36, 45–48, 52, 53 (+ T. d. F., D.).

Common, and universally distributed, the best and largest examples at Stations 8, 9, 16, and 36. This curious little form with a looped aperture is one of the distinctive forms of the "Terra Nova" gatherings, many of the specimens agreeing definitely with Brady's type, others with the starved thin-walled specimens which have so long been associated in British records with *P. karsteni*. Brady, who was first responsible for the addition of *P. karsteni* to the British records (B. 1864, RFS. p. 470, pl. xlviii, fig. 15), must have been quite familiar with these British individuals, and it is extraordinary that he should have copied Reuss's figure of the thick-walled true *karsteni* type to illustrate the comparatively minute British form. The records of the two are probably inextricably mixed. Brady, in recording his new form *P. exigua*, makes no reference to its occurrence elsewhere than in the North and South Atlantic, the Southern Ocean and Pacific, and treats it as an essentially deep-water form.

589. *Pulvinulina pauperata*, Parker and Jones.

Pulvinulina pauperata, Parker and Jones, 1865, NAAF. p. 395, pl. xvi, figs. 50, 51, *a*, *b*.
,, ,, Cushman, 1910, etc., FNP. 1915, p. 61, pl. xxiii, figs. 2, 3, and fig. 58 in text.

Stations 7, 16–19, 22, 23.

With the exception of Station 7, confined to deep-water Stations. Specimens rare except at Stations 16 and 22. At Station 16 it attains a very large size, but the specimens are dead and eroded shells.

590. *Pulvinulina schreibersii* (d'Orbigny).

Rotalina schreibersii, d'Orbigny, 1846, FFV. p. 154, pl. viii, figs. 4–6.
Pulvinulina schreibersii, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 716.

Stations 2, 3, 6 (+ R. d. J.).

Very rare, but large and typical at Station 6.

591. *Pulvinulina procera*, Brady.

Pulvinulina procera, Brady, 1879, etc., RRC. 1881, p. 66; 1884, FC. p. 698, pl. cv, fig. 7.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 717.

Station 1.

A single small but typical individual.

592. *Pulvinulina karsteni* (Reuss).

Rotalia karsteni, Reuss, 1855, KKM. p. 273, pl. ix, fig. 6.
Pulvinulina karsteni, Brady, 1864, RFS. p. 470, pl. xlviii, fig. 15 (after Reuss); 1884, FC. p. 698, pl. cv, figs. 8, 9.
„ „ Heron-Allen and Earland, 1916, FWS. p. 276, pl. xlii, figs. 34–37.

Stations 1–6, 11, 16, 18, 19, 23, 36 (+ T. d. F.).

Strong, thick-walled individuals of the Reuss-Brady type. Common. The only noteworthy point is the occurrence of typical individuals at the shallow water N.Z. Stations, though there are records in lesser depths. (*See* note to *P. exigua.*)

593. *Pulvinulina elegans* (d'Orbigny).

Rotalia (*Turbinulina*) *elegans*, d'Orbigny, 1826, TMC. p. 276, no. 54.
Pulvinulina elegans, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 717.

Stations 1–3, 6–8, 10, 11, 23, 36 (+ T. d. F., R. d. J.).

Frequent, and well developed at most of the N.Z. Stations, especially Stations 1, 2 and 6. Most of the specimens are of a hyaline texture, even when the walls are thick. Pauperate, thin-walled, compressed specimens at Stations 2 and 3. A thick-walled deep-water specimen at Station 7. At Station 10 a considerable number of very small and very thin-walled individuals. A specimen sessile on a Hydroid stem at Station 2.

594. *Pulvinulina partschiana* (d'Orbigny).

Rotalina partschiana, d'Orbigny, 1846, FFV. p. 153, pl. vii, figs. 28–30, pl. viii, figs. 1–3.
Pulvinulina partschiana, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 717; pl. liii, figs. 12–14.

Stations 6, 7, 10, 11, 12, 14, 36.

This species is biologically inseparable from *P. elegans*. The name has been reserved for the very thick benthic forms of that species. Such individuals occur, typical and well-developed, at Station 7, an interesting series of specimens showing the decomposition of the shell-wall by the separation of the laminae of which it is composed. Similar specimens at Station 11, but less advanced in lamination. A monstrous or double individual at Station 36.

595. *Pulvinulina berthelotiana* (d'Orbigny).

Rotalina berthelotiana, d'Orbigny, 1839, FIC. p. 130, pl. i, figs. 31–33.
Pulvinulina „ Brady, 1884, FC. p. 701, pl. cvi, figs. 1 *a–c.*
„ „ de Amicis, 1893, CFP. p. 455, pl. iii, figs. 12, *a–c.*

Stations 1 and 2.

Fine and large specimens. Some very limbate, others almost smooth.

596. *Pulvinulina favus*, Brady.

Pulvinulina favus, Brady, 1877, FNB. p. 534; 1884, FC. p. 701, pl. civ, figs. 12–16.
„ „ Chapman, 1910, FOF. p. 423, pl. lv, fig. 15.

Station 3.

One fossil, not typical.

ROTALIA, Lamarck.

597. *Rotalia beccarii* (Linné).

Nautilus beccarii, Linné, 1767, SN. (ed. xii), p. 1,162, no. 276.
Rotalia „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 717.

Stations 2, 4–6, 25, 27, 47 (+ K. I.).

The extraordinary rarity of this dominant species is astonishing. At most Stations it is represented by one or two feeble specimens, the best at Station 5.

598. *Rotalia perlucida*, Heron-Allen and Earland.

Rotalia beccarii (*pars*), Balkwill and Wright, 1885, DIS. p. 351.
„ *perlucida*, Heron-Allen and Earland, 1913, CI. p. 139, pl. xiii, figs. 7–9; 1914, etc., FKA. 1915, p. 718; 1916, FWS. p. 277.

Stations 6, 8, 36.

A few typical examples. The description by Reuss of his species *Rotalina nitida* seems to indicate that his form had something in common with ours (R. 1844, KWB. p. 214) but he gives no figure, and the figures published in his later paper (R. 1845–6, VBK. p. 35, pl. viii, fig. 52; pl. xii, figs. 8, 20) are quite unidentifiable.

599. *Rotalia orbicularis* (d'Orbigny).

Gyroidina orbicularis, d'Orbigny, 1826, TMC. p. 278, no. 1, Modèle no. 13.
Rotalia „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 718.

Stations 6, 10, 11 (+ R. d. J., D.).

Many excellent examples at each Station. Brady's figure (pl. cvii, fig. 5) is very misleading, it has nothing in common with d'Orbigny's Model and is clearly a pauperate form of *R. beccarii*, very near *R. perlucida*.

600. *Rotalia soldanii*, d'Orbigny.

Rotalia (*Gyroidina*) *soldanii*, d'Orbigny, 1826, TMC. p. 278, no. 5, Modèle no. 36.
„ *soldanii*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 719.

Stations 2, 3, 5–9, 12, 16–19, 22, 27, 29, 32 (+ T. d. F., R. d. J.).

Universally distributed, and frequent as far as Station 16. From thence it becomes smaller and rarer, and at the most southerly Stations the examples become very small and pauperate. Its maximum development in size at Station

6, where it is common, almost equally good at Stations 8 and 12. In the N.Z. area, especially at Stations 2, 3 and 6, a variety occurs in which the involution of the earlier whorls is carried to such an extent that the final chamber overlaps and gives a nonionine appearance to the test. Fossils of the type occur at Stations 2, 3 and 6.

601. *Rotalia soldanii*, var. *arenacea*, nov. Pl. VII, figs, 29–31.

At Station 28 a specimen, which we figure, built up of fine sand-grains with ferruginous cement. The aperture is large and gaping. Surface-texture neat and smooth, but without excess of cement. Its nearest ally, in the Lituolidae, would probably be *Haplophragmium glomeratum*, with which it agrees in the number and method of arrangement of chambers, but differs in the dissimilarity of the axial extremities, one being drawn out as in *H. glomeratum*, the other being flattened and depressed as in the rotalian type. Brady, in his description of *H. glomeratum*, appears to have met with similar specimens, as he refers to asymmetrical specimens, having one end broader than the other, and with excavated umbilici.

We have similar specimens from Annam.

Size :—Breadth, ·40 mm. ; height, ·30 mm.

602. *Rotalia papillosa*, var. *compressiuscula*, Brady.

Rotalia papillosa, var. *compressiuscula*, Brady, 1884, FC. p. 708, pl. cvii, fig. 1 ; pl. cviii, fig. 1.
" " " " Cushman, 1910, etc., FNP. 1915, p. 70, pl. xxx, fig. 1.

Station 2.

A few fossil specimens.

603. *Rotalia craticulata*, Parker and Jones.

Rotalia craticulata, Parker and Jones, 1865, NAAF. pp. 387, 422, pl. xix, fig. 12.

Station 6.

A few specimens, mostly fossil, which are referable to this species, which, judging from its markings and their occurrence at the Station where *R. clathrata* reaches its maximum development, is probably a pauperate form of that species.

604. *Rotalia clathrata*, Brady.

Rotalia clathrata, Brady, 1884, FC. p. 709, pl. cvii, figs. 8, 9.
" " Jones and Chapman, 1900, MCI. p. 232, pl. xx, fig. 2.

Stations 2–8, 10, 11.

Common in the N.Z. area and reaching its maximum development and variation at Station 6. The species varies enormously in the relative convexity of the two faces, and the degree of strength of the costae traversing the walls of the chambers. In its most compressed form the superior face is absolutely flat and the inferior but slightly convex. Such specimens are only separable externally

from *Polystomella verriculata* by the character of their markings, and when the costae become intricate or labyrinthic, as they sometimes do, the only distinction observable is the apertural edge and the nature of the orifice. South of Station 6 the species dies out, becoming less abundant and characteristic. At its final Station, 11, it has lost all regularity of costation, and the few weak individuals are covered with a reticulate mesh. Many natural glauconitic casts at Station 6. These reveal the presence of an intricate secondary canal-system.

Sub-Family TINOPORINAE.

GYPSINA, Carter.

605. *Gypsina inhaerens* (Schultze).

Acervulina inhaerens, Schultze, 1854, OP. p. 68, pl. vi, fig. 12.
Gypsina inhaerens, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 724.

Stations 1–3, 6, 10.

Confined to the N.Z. area. Abundant and extremely variable, both in size of specimens and of the constituent chambers. The best series covering all possible variations, both free and sessile at Station 6. Almost equally good at Stations 1 and 2. The species incrusts stones and organisms of every description.

[Arenaceous isomorph, *Trochammina uviformis*, Grzyb., and allied forms.]

606. *Gypsina vesicularis* (Parker and Jones).

Orbitolina vesicularis, Parker and Jones, 1859, etc., NF. 1860, p. 31, no. 5.
Gypsina „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 726.

Stations 1–3, 5, 6.

Much more abundant than *G. globulus*, and often very nearly passing into that form. The best at Stations 1 and 5, attached specimens at Station 2.

607. *Gypsina globulus* (Reuss).

Ceriopora globulus, Reuss, 1847, Haidinger's Naturw. Abh., vol. ii, p. 33. pl. v, fig. 7.
Gypsina „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 727.

Stations 1, 5, 6.

Rare, but good. One very large specimen at Station 6.

POLYTREMA, Risso.

608. *Polytrema miniaceum* (Pallas). Pl. VIII, figs. 1–31.

Millepora miniacea, Pallas. Elenchus Zoophytorum. (Hague, 1766), p. 251.
„ „ Linné, 1788, SN. p. 3,784, no. 6.
„ „ Defrance, 1824, Dict. Sci. Nat., vol. xxxi, p. 82.
„ „ Blainville, 1834, Manuel d'Actinologie, p. 410.
Polytrema „ Carpenter, Parker and Jones, 1862, ISF. pp. 228, 235, pl. xiii, figs. 18–20.
„ *miniaceum*, Carter, 1870, HR. pp. 389–392; 1876, P. p. 185, pl. xiii, figs. 1–6; 1879, NF. p. 411.

Polytrema	*miniaceum.*	Möbius, 1880, FM. p. 85, pl. vii.
,,	,,	Brady, 1884, FC. p. 721, pl. c, figs. 5–9, pl. ci, fig. 1.
,,	,,	Schlumberger, 1892, FAM. p. 196, fig. 5.
,,	,,	Chapman, 1899, FFA. p. 16, pl. iv, fig. 7.
,,	,,	Merkel, 1900, Beiträge zur Kentniss des Baues von *Polytrema miniaceum*, Zeitschr., f. wiss. Zool. Bd. lxvii, pp. 291–322, pls. xvi, xvii.
,,	,,	Sidebottom, 1904, etc., RFD. 1909, p. 11, pl. iv, fig. 7.
,,	,,	Hickson, 1911, P. (*entire paper*), pls. xxx–xxxii.
,,	,,	Heron-Allen and Earland, q.v. *re* Risso. 1914. etc., FKA. 1915, p. 728.
,,	,,	Cushman, 1919, RFNZ. p. 632.
,,	,,	Heron-Allen and Earland, 1920, V.P., p. 165; 1922, Bull. Soc. Sci. Hist. and Nat. Corse. (Bastia, Corsica). *In the press.*

Stations 1–6.

The abundance of this species in the N.Z. area, and especially at Station 2, where practically every solid organism is more or less covered with it, has enabled us to make a noteworthy contribution to the large body of facts which have already been recorded about this genus, and our observations have been amplified by the examination of an unlimited supply of material from the "sables rouges" of Ajaccio (Corsica) which seemed to us to promise so much light upon the subject that we proceeded thither for the purpose of collecting and studying the organism. Our journey was amply repaid.

Early "Free" Stage.—Carter, in 1876 (P., p. 196), in referring to "one mounted, rounded, embryonic specimen from Mauritius," appears to have anticipated Schlumberger in the discovery of the free stage in the life-history of this organism, but, beyond this brief statement, does not seem to have followed the matter up. Schlumberger (*ut supra*) describes, and figures a transverse section of, the free organism; he states that "it shows three spherical chambers with their walls traversed by a few perforations, and arranged like the embryonal chambers of a *Globigerina*, except that one cannot demonstrate any special opening between one chamber and another. Around these three chambers it forms, irregularly, a covering layer of chambers of all shapes and sizes. They have thick walls traversed by strong perforations which increase in diameter from the interior to the exterior. The succeeding (outer) chambers are often drawn out into points, incorporating sand-grains in their walls, and end by fixing the embryo to some submarine body." In our experience the feature of the drawn-out chambers is rare, but we have admirable examples from Ajaccio. This free stage was described and figured again by Sidebottom from Delos (*ut supra.*).

The abundant supply of free individuals placed at our command enables us to make some additions and corrections to the foregoing. The smallest specimens observed in the free state (Figs. 1–3) are flattened and consist of four chambers, two of them of comparatively large size, apparently connected with one another by an intermediate neck, and having two smaller chambers filling up the curves (equitant) between the neck and the two larger chambers. The whole organism

is thus cruciform in shape, with the angles rounded off. No external aperture is, as a rule, visible at this stage, but at Station 3 a four-chambered individual with a slit-like aperture was found. The peripheral walls are rather thick, but are thinner on the flattened faces. In the next stage a fifth chamber is added between two of the chambers of the "cross," and the shell now attains a distinctly rotaline appearance, and has a characteristic rotaline slit-like aperture. Successive chambers are added, at first in a regular spiral (as figured by Merkel) and subsequently irregularly, so as to surround the whole test, which becomes roughly globular with projecting spherules—like a raspberry (Figs. 4–7); and, if this stage of growth continues, tends to become more or less irregular and *Gypsina*-like in form. How long this free stage of existence may continue, in the event of the creature not attaining a congenial host, we cannot say, but some of our specimens—especially from Ajaccio—are considerably larger than the normal size of the individuals passing into the next, or attached, stage.

So far as we are aware, no one has yet described or illustrated the actual method of attachment. Our large series of N.Z. and Corsican specimens has made this quite clear. The free organism settles upon some suitable object; from its under surface it projects protoplasm and forms a thin layer of incrusting chambers connecting it with its host. At this stage (Figs. 8, 9) the method of attachment is not visible round the edges of the young shell, but is easily verified by detaching the individual, or it may be demonstrated in the cases of specimens which have become attached by these delicate connecting chamberlets, and have subsequently broken away again. From these earliest basal chambers the protoplasm then streams out round the spherical embryo, and commences to build an investing wall of chamberlets rising round the edges and sides and finally creeping over and enveloping the young individual, as a dome—or nipple shaped—"house" (Figs. 11–18) from which the development of further chambers proceeds, ultimately extending into those branching arms which complete the type (Figs. 19, 21, 22). All stages in this process have been observed in the material at our command.

It must not be understood from the foregoing that we regard this as the only, or possibly even the most usual, development of *Polytrema*. In our material the species occurs literally by millions; and under such conditions young, free specimens would be expected to occur in similar abundance, but in point of fact, while in the Corsican material the free stage is extremely common, in the N.Z. material, though a large quantity was very carefully examined, the total number of specimens of this free form was probably under 150. On the other hand, if a series of detached adult individuals is examined, many specimens will be found exhibiting a few central rotaline chambers exposed on the flat base. Our observations of the attachment of the free form show that a layer of small chamberlets is interposed between the "raspberry" stage and the point of

attachment, and these, coupled with the outer chamberlets of the free form, constitute a basal layer sufficiently thick to mask entirely the rotaline arrangement of the free form. It seems probable that an alternative method of growth is for the young individual to settle direct as a primordial chamber on its host, and then to construct a minute rotaline test, which, until masked by the superimposition of chamberlets, would be indistinguishable from a young sessile specimen of *Truncatulina* or *Discorbina* (Fig. 29).

Adult "Sessile" Stage.—Throughout these early stages the shell-wall is very thin and delicate, exhibiting the characteristic tubulation of *Polytrema* very distinctly. With advancing growth many of the specimens become very thick-walled, owing to the deposition of shell-matter in solid layers, or as tubular outgrowths from the surface. These outgrowths of shell-substance are usually of a much deeper tint than the surrounding test. The continual formation of thin investing layers of chambers leads to the formation of deeply sunken pits, more or less circular in outline (Fig. 26). In many of these pits or "craters" the circular floors are seen to be finely tubulated, suggesting, at first sight, an attribution to *Homotrema*, Hickson, instead of to *Polytrema*, but the persistent tubulation of the high ridges surrounding these craters is characteristic of *Polytrema*, and there can be no doubt but that these sunken circular patches represent the initial stages of development of the "pillar-pores" marking the genus, and that their origin is due to the spreading of a new stratum of protoplasm over the previously formed shell in an alveolar layer instead of in a solid film. We have observed similar specimens from other localities. No specimens of *Homotrema* were found in either the "Terra Nova" or the Corsican material, and its distinctive characters are such that it could not be overlooked.

The occurrence of siliceous spicules inside the chambers has furnished material for many controversies in the past. Carter (1870 and 1876) who had a highly critical mind, and was also a Sponge specialist, and Schultze before him had no doubt whatever in attributing their occurrence to the inception of the spicules by the organism, either as food or as "ingesta," which by accident have been drawn in by the pseudopodia and have accumulated like the hairs forming the "hair-ball" in an ox's stomach. The N.Z. specimens are not so spiculiferous as those from other localities which we have examined, but an amount of this material was worked out which satisfies us that the adventitious character of the spicules is beyond question. They are usually confined to the apertural arms and the external layer of chamberlets, and they represent forms characteristic of widely separated groups of Sponges, usually Monaxonid, but occasionally Tetractinellid. The curious sickle-shaped flesh-spicules characteristic of some sponges have been identified. When the spicules are small they are often quite perfect, but larger spicules are usually more or less broken. Diatoms, Radiolaria, and other minute organisms are also found ingested in the chambers.

Whether there is any true symbiosis between *Polytrema* and Sponges we are unable to say, but specimens have been found in which the whole of the outer surface was furry with minute projecting spicules. The Sponge, if incrusting the *Polytrema*, must have been in an infinitely thin layer; it seems possible therefore that the sponge-tissue and the protoplasm of the *Polytrema* may have been intermingled under the outer shell-surface. Other specimens were seen in which a Sponge with large, strong, projecting spicules was living in association with *Polytrema*, at any rate to the extent that the two organisms were close together and approximately the same size (Fig. 31). With such a rapidly-growing organism as *Polytrema* it is fairly evident that at the next stage the spreading chambers would envelop the Sponge. If symbiosis did not then occur, the large number of strong spicules enclosed in the *Polytrema* would be analogous to those highly-spiculiferous specimens which have occasioned so much controversy in the past.

Several specimens exhibit evidence that the greater part of the internal structure has been eaten out by another organism, leaving a more or less spherical cavity. Of the nature of this enemy we have no evidence, but, starting from the surface of the trunk it apparently tunnels into the thickest part of the shell, often hollowing out the interior of the trunk right down to the base (Figs. 23, 24).

Polytrema, like most, if not all, other Foraminifera, has a chitinous membrane lining the shell-wall. This is exceptionally thick in the earliest (Figs. 27, 28, 30), and consequently the oldest, chambers, becoming very delicate in the extended arms.

The general form of the N.Z. specimens is erect and branching, but depressed and squamous forms, so common in the Mediterranean, also occur. The colour is pale; no highly-coloured individuals were observed. It varies from pale pink to very faint flesh-colour, practically indistinguishable from the var. *alba* (Carter). The nature of the preservatives employed may be partially responsible for this.

As above indicated, the exhaustive examination of the Corsican material has served to confirm all the points upon which we have laid stress in discussing the "Terra Nova" material, including the normal occurrence of a microspheric type commencing its existence as a minute sessile truncatuline individual. The Corsican material presents several minor points of distinction as compared with the "Terra Nova" gatherings.

1. The early free stage is much more abundant and the individual specimens attain a much larger size and more advanced development than in N.Z.

2. The colour variation is much wider, ranging between the most vivid blood-red and pure white. This may be partly due to the freshness of the Corsican material, as the colouring matter of *Polytrema* is unquestionably more or less fugitive.

3. The Corsican specimens are of a more massive type than those from N.Z., and delicately branching individuals are comparatively rare. This is probably

due to the greater depth of water in the N.Z. area. We were interested to observe that the Corsican specimens suffered from the depredations of an identical or similar enemy, many of them being completely riddled with holes and tubular borings. They are probably the work of minute Annelids or Crustacea, which live on the protoplasm of the *Polytrema*. As to the colouring-matter characteristic of the genus, see page 247.

609. *Polytrema miniaceum*, var. *alba*, Carter.

Polytrema miniaceum, var. *album*, Carter, 1877, CB. p. 213, pl. xiii, figs. 14, 15.
„ „ „ *alba*, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 728.

Station 2.

At Station 2 unquestionable examples, finely branching and in perfect condition, were found. At nearly all the other Stations individuals which in the ordinary course would have been ascribed to this variety, owing to their pale colour, occur. At Station 2 a branching specimen of the variety was found, on the broken terminal of one branch of which a young individual of typical red *P. miniaceum* had settled down to commence its sessile life, encrusting the var. *alba*. At Station 6 a small individual of typical var. *alba* as regards the base, passed into pale *P. miniaceum* in the branching arms; this appears to us to show that the colour is more or less adventitious.

Family NUMMULINIDAE.
Sub-Family POLYSTOMELLINAE.
NONIONINA, d'Orbigny.

610. *Nonionina depressula* (Walker and Jacob).

Nautilus depressulus, Walker and Jacob, 1798, AEM. p. 641, pl. xiv, fig. 33.
Nonionina depressula, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 730.

Stations 1–3, 5, 6, 8–11, 16, 17, 23, 26, 27, 29–31, 33, 36, 38, 45, 47, 48, 50, 52, 54, 55 (+ R. d. J., D.).

Universally distributed and presenting little variation throughout the area, excepting in the deep-water Stations, where the specimens are, as a rule, smaller and more pauperate. At the most southerly Stations, 45–54, the best and most typical series occur. At Station 6, the best in the N.Z area, there is a tendency in many of the specimens to stellate limbation at the umbilicus, giving a superficial resemblance to *N. stelligera*. Fossil examples at Stations 2, 3 and 6.

[Arenaceous isomorph, *Haplophragmium canariense* (d'Orb.) *pars*, = *H. nonioninoides*, Rss. (R. 1862, NHG. p. 30, pl. i, fig. 8).]

611. *Nonionina asterizans* (Fichtel and Moll).

Nautilus asterizans, Fichtel and Moll, 1798, TM. p. 37, pl. iii, figs. *e–h*.
Nonionina „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 730.

Stations 4–8, 10, 54.

Very rare, but good specimens at the early N.Z. Stations. Very minute at Stations 8 and 10. A single individual at Station 54.

612. *Nonionina stelligera*, d'Orbigny.

Nonionina stelligera, d'Orbigny, 1839, FIC. p. 128. pl. iii, figs. 1, 2.
„ „ Heron-Allen and Earland, 1916, FWS. p. 280, pl. xliii, figs. 8–10.

Stations 3, 6, 7, 9–11, 26, 27, 31, 38, 45, 46, 48, 50, 53–55 (+ D.).

Universally distributed, except at the deep-water Stations. Best at Stations 7 and 10 in the N.Z. area, and at Stations 27, 31, 38 and 50 in the Antarctic. This is a typically Arctic species so far as records go, and its occurrence in similarly high Antarctic latitudes is noteworthy. It is probably the most abundant representative of the genus in the Antarctic, and a similar prevalence occurs in Arctic dredgings from Iceland which we have examined. Extremely rare in temperate tropical seas.

613. *Nonionina umbilicatula* (Montagu).

Nautilus umbilicatulus, Montagu, 1803–8, TB. p. 191 ; Suppl. p. 78, pl. xviii, fig. 1.
Nonionina umbilicatula, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 730.

Stations 2, 3, 6–12, 16, 18, 19, 22, 23, 29, 49, 50 (+ T. d. F., D.).

Generally distributed ; exceptionally good at Stations 6, 7, and 16. At Station 18 the examples are very thick, approaching *N. pompilioides*. Fossils at Stations 3 and 6.

[Arenaceous isomorph, *Haplophragmium canariense* (d'Orb.).]

614. *Nonionina pompilioides* (Fichtel and Moll).

Nautilus pompilioides, Fichtel and Moll, 1798, TM, p. 31, pl. ii, figs. *a–c*.
Nonionina „ Cushman, 1910, etc., FNP. 1914, p. 25, pl. xvii, fig. 2.

Stations 6, 7, 16, 17, 20, 23.

Good specimens at all the Stations. Its occurrence in such shallow water at Station 6, where excellent recent examples were found, is noteworthy, this being essentially a deep-water form.

[Arenaceous isomorph, *Haplophragmium scitulum*, Brady.]

615. *Nonionina boueana*, d'Orbigny.

Nonionina boueana, d'Orbigny, 1846, FFV. p. 108, pl. v, figs. 11, 12.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 731.

Stations 2–8, 11 (+ R. d. J.).

Confined to the N.Z. area ; most abundant at Station 6. Rare and small at Stations 7, 8, and 11. At Stations 5 and 6 there is a considerable range of variation, including inaequilateral individuals comparable with var. *janiformis*, Rupert Jones (J. P. & B. 1866, etc., MFC. 1897, p. 344, Text-fig. 28 *a–c*), but

differing from the Crag specimens in having the acute peripheral edge of the type. In the N.Z. specimen of var. *janiformis* all the chambers are visible on the flattened face, while on the other, the umbilical recess is covered with the strong tuberculations which generally characterize the species in this area.

[Arenaceous isomorph, of var. *janiformis*, *Haplophragmium nanum*, Brady.]

616. *Nonionina scapha* (Fichtel and Moll).

Nautilus scapha, Fichtel and Moll, 1798, TM. p. 105, pl. xix, figs. *d–f*.
Nonionina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 731.

Stations 5–9, 19, 31 (+ R. d. J., D.).

Poorly represented at the Stations. All the specimens are small and pauperate, tending sometimes in the direction of excessive prolongation, approaching *N. sloanii* (O. 1839, FC. p. 46, pl. vi, fig. 8) and others, in the direction of the turgid, evolute form figured by Brady (1884, FC. pl. cix), fig. 16.

617. *Nonionina communis*, d'Orbigny.

Nonionina communis, d'Orbigny, 1826, TMC. p. 294, no. 20.; 1846, FFV. p. 106, pl. v, figs. 7, 8.
,, ,, Terrigi, 1880, SGP. p. 218, pl. iv, figs. 75, 76.

Stations 2, 6, 18, 26, 45, 48, 53.

Very rare. Occasional specimens only.

618. *Nonionina turgida* (Williamson).

Rotalina turgida, Williamson, 1858, RFGB. p. 50, pl. iv, figs. 95–97.
Nonionina turgida, Cushman, 1910, etc., FNP. 1914, p. 29, pl. xv, fig. 3.

Stations 2, 3, 6, 8–10, 26, 27, 31, 48 (+ R. d. J., D.).

Fairly frequent, the best and most abundant at Station 27. In addition to the normal type, a very long form, representing a *N. turgida* variation of *N. sloanii*, occurs at several Stations, particularly at Station 6.

619. *Nonionina turgida*, var. *arenacea*, nov. Pl. VII, figs. 36–38.

Station 26.

A single individual, built up of very fine sand-grains and ferruginous cement Surface smooth, but not polished. Septation very obscure, resembling the hyaline type.

Size :—Length, ·37 mm.; breadth, ·22 mm.; maximum thickness, ·20 mm.

620. *Nonionina pauperata*, Balkwill and Wright.

Nonionina pauperata, Balkwill and Wright, 1885, DIS. p. 353, pl. xiii, figs. 25, 26.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 732.

Stations 4–6.

Perfectly typical specimens at Stations 5 and 6.

POLYSTOMELLA, Lamarck.

621. *Polystomella faba* (Fichtel and Moll).

Nautilus faba, Fichtel and Moll, 1798, TM. p. 103, pl. xix, figs. *a–c*.
Polystomella faba, Heron-Allen and Earland, 1916, FWS. p. 281, pl. xliii, figs. 11–19.

Stations 27, 30.

Several typical specimens.

622. *Polystomella decipiens*, Costa.

Polystomella decipiens, Costa, 1853, etc., PRN. 1856, p. 220, pl. xix, fig. 13.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 732; 1916, FWS. p. 282, pl. xliii, figs. 20–22.

Stations 7, 8.

A few typical specimens.

623. *Polystomella striato-punctata* (Fichtel and Moll).

Nautilus striato-punctatus, Fichtel and Moll, 1798, TM. p. 61, pl. ix, figs. *a*, *b*, *c*.
Polystomella striato-punctata, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 732.

Stations 2, 4–6, 28, 48 (+ R. d. J.).

Singularly rare, but good specimens, especially at the N.Z. Stations.

624. *Polystomella striato-punctata*, var. *selseyensis*, Heron-Allen and Earland.

„ „ Heron-Allen and Earland, 1908, etc., SB. 1909, p. 695, pl. xxi, fig. 2. Ditto. var. *selseyensis*, *ibid*, 1911, p. 448 (Catalogue). 1913, CI. p. 146; 1914, etc., FKA. 1915, p. 733; 1916, FWS. p. 282.

Stations 2, 50.

Typical specimens, especially at Station 2.

625. *Polystomella subnodosa* (Münster).

Robulina subnodosa, Münster, *fide* Roemer, 1838, CNTM. p. 391, pl. iii, fig. 61.
Polystomella „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 733.

Stations 3–8.

Many excellent examples at Station 6. Rarer and smaller at the other Stations. A few fossils at Station 6.

626. *Polystomella crispa* (Linné.)

Nautilus crispus, Linné, 1767, SN. p. 1162, no. 275; 1788, p. 3370, no. 3.
Polystomella crispa, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 733.

Stations 2, 3, 6, 8.

Minute recent specimens at Station 8. Fossils at the other Stations, small but typical.

627. *Polystomella macella* (Fichtel and Moll).

Nautilus macellus, Fichtel and Moll, 1798, TM. p. 66, pl. x, figs. *e–g*.
Polystomella macella, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 734.

Stations 1–3, 4–6.

Large and excellent recent examples, except at Stations 3 and 4. Excellent fossils at Stations 2, 3 and 6.

Sub-Family NUMMULITINAE.

OPERCULINA, d'Orbigny.

628. *Operculina ammonoides* (Gronovius).

Nautilus ammonoides, Gronovius, 1781, ZG. p. 282, no. 1,220, pl. xix (Fasc. iii, Tab. 2), figs. 5, 6.
Operculina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 737.

Stations 6, 26, 49, 55 (+ K. I.).

Typical and well developed at the two southernmost Stations. Small and weak at the other Stations. This is normally an Arctic form, but it occurs in a pauperate condition all over the world.

V. APPENDIX.

A.—OFF TIERRA DEL FUEGO.

Station. Official list 308.—H.-A. & E., Station 56. See description of the material, *ante*, p. 58.

This small tube of soundings, whilst properly Antarctic, or, rather, coming under our Section 2 (of deep-water Stations between 51° and 72° S.), had it not been from a locality so far away from the group of localities the subject of our Report, would have come between our Stations 13 and 14, being situated in 55° 29′ S., and 78° 54′ W.—" 2,356 fms., to the west of Tierra del Fuego."

Being, like Official Station 42, in the nature of an isolated gathering, we have preferred to deal with it separately, like that Station, in an Appendix.

The following species were found at this Station which were not found elsewhere in the material submitted to us. The other species found at the Station are indicated by the letters " T. d. F." after the lists of Stations for the species recorded in the Report.

629. *Aschemonella catenata* (Norman).

Astrorhiza catenata, Norman, 1876, Proc. Roy. Soc., vol. xxv, p. 213.
Aschemonella catenata, Brady, 1879, etc., RRC. 1879, p. 42, pl. iv, figs. 12, 13 ; 1884, FC. p. 271, pl. xxvii, figs. 1–11 ; pl. xxvii *a*, figs. 1–3.

One small and not very satisfactory specimen.

630. *Pleurostomella subnodosa* (Reuss).

Nodosaria nodosa, Reuss, 1845-6, VBK, pt. i, p. 28, pl. xiii, fig. 22.
Pleurostomella subnodosa, Cushman, 1910, etc., FNP. 1911, p. 51, fig. 82.

One typical specimen.

B.—ROYAL SOUND, KERGUELEN ISLAND.

"Challenger" Station 149 E., 28 fms.

When we commenced our work on the "Terra Nova" gatherings, and two days before his death, our old friend Sir John Murray gave us a tube of material, labelled as above, which is of interest, for comparison, in connexion with this report. Brady, in 1884 FC., says that only poor specimens of common littoral and shallow-water species were found in it. The examination of the material by Brady and his assistants must have been extremely superficial—the species found by us in 12·5 cm. of washed material number forty-two, four of which were not found by us in the "Terra Nova" gatherings. These are as follows, the other species being indicated in the body of our Report by the letters "K. I." after the lists of Stations for the species recorded.

631. *Miliolina rotunda* (d'Orbigny).

Triloculina rotunda, d'Orbigny, 1826, TMC. p. 299, no. 4.
Miliolina ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 568, pl. xlii, figs. 27–30.

Two good and typical specimens.

632. *Technitella legumen*, Norman.

Technitella legumen, Norman, 1878, GH. p. 279, pl. xvi, figs. 3, 4.
,, ,, Cushman, 1910, etc. FNP. 1910, p. 48, fig. 53.

A small but typical specimen, of which the oral extremity is broken away. This is recorded by Brady from Kerguelen, but not from Station 149 E.

633. *Storthosphaera depressa*, Pearcey.

Storthosphaera depressa, Pearcey, 1900, RCA. p. 37, pl. i, fig. 1.

A single large specimen agreeing very well with Pearcey's description and figure.

634. *Lagena clavata* (d'Orbigny).

Oolina clavata, d'Orbigny, 1846, FFV, p. 24, pl. i, figs. 2, 3.
Lagena ,, Cushman, 1910, etc., FNP. 1913, p. 9, pl. ii, fig. 3.

Two typical specimens, and others, passing into *L. gracillima*.

C.—OFF THE COAST OF RIO DE JANEIRO.

Official Station 42, "Off the Coast of Rio de Janeiro," 22° 56′ S. 41° 34′ W.—40 fms.

Among the material submitted to us for examination was a small jar of organic débris and muddy sand, bearing the above particulars. The organic remains consisted of fragments of large mud-eating worms; these were treated with caustic potash, and a considerable amount of material was thus obtained. There was also a small jar of similar sand, broken shells and minute fishes, obviously rubbish from a trawl-net, bearing no label, and without any indications whatever of locality or depth. On washing this material, it became clear that this also came from Station 42. As this was an isolated gathering, from a locality far removed from those forming the subject of the foregoing Report, we have not recorded the species therein found among our N.Z. and Antarctic records, but we have appended the letters "R. d. J." after the lists of Stations where they were found in those areas. The following nine species call for special mention, not having been recorded elsewhere in this Report.

635. *Biloculina laevis* (Defrance).

Pyrgo laevis, Defrance, 1824, Dict. Sci. Nat., vol. xxxii, p. 273; Atlas Conch., pl. lxxxviii, fig. 2.
Biloculina laevis, Millett, 1898, etc., FM. 1898, p 263.

This so-called species differs from *B. depressa* only in the distinctiveness with which the marginal edge of the penultimate chamber is exposed, running parallel with the peripheral edge of the ultimate chamber, and thus forming a bicarinate test. A single quite typical specimen occurred in this material.

636. *Miliolina auberiana*, var. *arenacea*, nov. Pl. I, fig. 1–3.

Structure exactly as in *M. auberiana*, but the shell is composed entirely of small calcareous sand-grains neatly cemented together. Surface smooth, and dull. Colour grey. Aperture as in the type, but small and furnished with a tooth.

Broken specimens do not reveal any porcellanous lining to the test. The material used as cement appears to be entirely calcareous, effervescing strongly under acid. The variety was quite common in the gathering.

Size :—·50–·70 mm. long; ·50–·60 mm. broad; ·25 mm. thick.

637. *Textularia barrettii*, Jones and Parker.

Textularia barrettii, Jones and Parker, 1863, FJ. pp. 80 and 105.
,, ,, Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 630.

Two very fine specimens.

638. *Cuneolina pavonia*, d'Orbigny.

Cuneolina pavonia, d'Orbigny, 1846, FFV. p. 253, pl. xxi, figs. 50, 52.
,, ,, Carpenter, Parker and Jones, 1862, ISF. p. 193, pl. xii, fig. 17.
Textularia trochus, Goës, 1882, RRCS. p. 80, pl. v, figs. 167–170.
,, *barrettii*, Flint, 1899, RFA. p. 285, pl. xxx, fig. 2.
Cuneolina pavonia, Cushman, 1919, FFWI. p. 34, pl. vii, fig. 1.

Some perfect specimens of this very rare and distinctive species. The above are the only records extant.

639. *Bolivina nobilis*, Hantken.

Bolivina nobilis, Hantken, 1875, CSS. p. 65, pl. xv, fig. 4.
„ „ Cushman, 1910, etc., FNP. 1911, p. 39, fig. 64.

Good and strongly marked specimens, not infrequent.

640. *Cristellaria cassis* (Fichtel and Moll).

Nautilus cassis, Fichtel and Moll, 1798, TM. p. 95, var. *a*, pl. xvii, *a–d*, var. *β* (*et passim*).
Cristellaria cassis, Brady, 1884, FC, p. 552, pl. lxviii, fig. 10.

A single large and very fine example.

641. *Uvigerina tenuistriata*, Reuss.

Uvigerina tenuistriata, Reuss, 1870, FSP. p. 485; and S., 1870, FSP. pl. xxii, figs. 34–37.
„ „ Cushman, 1910, etc., FNP. 1913, p. 95, pl. xlii, fig. 4.

Two good specimens.

642. *Discorbina tuberculata*, Balkwill and Wright.

Discorbina tuberculata, Balkwill and Wright, 1885, DIS. p. 350, pl. xiii, figs. 28–30.
„ „ Heron-Allen and Earland, 1914, etc., FKA. 1915, p. 695.

A large and typical specimen. Of this usually small form there are but few records, but it is probably of fairly wide distribution. We have recorded it from Kerimba Archipelago (*ut supra*).

643. *Anomalina foveolata*, Brady.

Anomalina foveolata, Brady, 1884, FC. p. 674, pl. xciv, fig. 1.
„ „ Egger, 1893, FG. p. 379, pl. xiv, figs. 13–15.

One specimen, becoming somewhat pauperate in the later chambers.

D.—MATERIAL COLLECTED BY THE "DISCOVERY" IN 1901–4.

Apart from the tubes of tow-nettings dealt with on pp. 37–38, the only "Discovery" material submitted to us consisted of a few small tubes containing single specimens in spirit, which had been selected on board the ship, and one tube containing mud.

The picked specimens consisted of *Cyclammina cancellata*, Brady. One large specimen found in trawl January 27, 1902, off "Discovery" Barrier in 300 fms. (mud). *Iridia diaphana*, Heron-Allen and Earland. Many specimens sessile on various objects. Taken Sept. 8, 1903 at 12 hole, Winter Quarters, and in March 1903 at 6 hole, Winter Quarters. The specimens are pauperate and thin, dark in colour, formed of very fine mineral grains and mud. No depths furnished.

Crithionina mamilla, Goës. Many specimens taken Nov. 27, 1902 at Winter

Quarters, 4 hole, 41 fms.; at 12 hole on Sept. 8, 1903, no depth stated; and at 6 hole on Jan. 14, 1903, 130 fms.

All the specimens are similarly built of fine dark grey mud with very long slender sponge-spicules irregularly projecting. Many of these spicules project half an inch or more. They are not sufficiently numerous to bring the specimens into any resemblance to *Crithionina pisum*, Goës, var. *hispida*, Flint. *Miliolina circularis* (Born.) was built into one specimen.

One of the specimens given to us was a fragmentary worm-tube from Winter Quarters, 6 hole, 130 fms. (Jan. 14, 1903, 77° 50′ 30″ S.; 166° 44′ 45″ E.) This was carefully broken up and yielded many species of Foraminifera.

The tube of mud bore the label, Station 270, March 4, 1904, 254 fms. (67° 21′ 46″ S.; 155° 21′ 10″ E.). This, having been washed, yielded about 2 c.c. of material which was relatively rich, giving us 104 species and varieties which we have indicated in our Report by the letter "D," after the list of Stations for recorded species.

Among these were eight that did not occur in the "Terra Nova" material, as follows:—

644. *Hippocrepina indivisa*, Parker.

Hippocrepina indivisa, Parker, 1870, GStL. p. 176, fig. 2.
„ „ Heron-Allen and Earland, 1913, CI. p. 48, pl. ii, figs. 10, 11.

A small broken individual, lacking the oral extremity, but undoubtedly referable to this species. Very thin-walled, constructed of extremely fine mud with ferruginous cement, deep rust-colour at the aboral point, fading into grey at the broken end. *Hippocrepina* has hitherto been regarded as an exclusively boreal form, and its southern limit, so far, has been in the Moray Firth. Its occurrence even as a single specimen is therefore extremely noteworthy.

644A. *Reophax guttifera*, Brady.

Reophax guttifera, Brady, 1884, FC. p. 295, pl. xxxi, figs. 10–15.
„ „ Cushman, 1910, etc., FNP. 1910, p. 88, fig. 123.

A single typical specimen.

645. *Bolivina textilarioides*, var. *arenacea*, nov. Pl. IV, figs. 29, 30.

Excellent isomorphs with characteristic bolivine aperture, built up of fine grey and black mineral particles. Many specimens, in some cases having as many as nine and ten pairs of chambers. One individual attached by its aperture to a large sand-grain by means of cement.

Size:—Length, ·20–·30 mm.; maximum breadth, ·13 mm.

646. *Bolivina variabilis*, var. *arenacea*, nov. Pl. IV, figs. 27, 28.

A single specimen, characterized by obscure septation and evenly continuous

marginal edge, appears to be isomorphous with the type. It is built up of coarse sand-grains and the aperture is normally bolivine.

Size :—Length, ·35 mm. ; breadth, ·15 mm.

647. *Lagena distoma*, Parker and Jones, MS.

Lagena distoma, Brady, 1864, RFS. p. 467, pl. xlviii, fig. 6.
„ „ Cushman, 1910, etc., FNP. 1913, p. 22, pl. xiii, figs. 1, 2.

A single small but typical specimen.

648. *Lagena orbignyana*, var. *alata*, Cushman.

Lagena orbignyana, var. *alata*, Cushman, 1910, etc., FNP. 1913, p. 45, pl. xxiii, fig. 1.

A single small but typical specimen.

649. *Lagena pannosa*, Millett.

Lagena pannosa, Millett, 1895, etc., FM. 1901, p. 11, pl. i, figs. 12–14.
„ „ Haeckel, 1900–04, Kunstformen der Natur., pl. lxxxi, fig. 3.
„ „ Sidebottom, 1912, etc., LSP. 1912, p. 398.

A single typical specimen, the neck somewhat more produced than in Millett's figure. The secondary shell-matter is extremely thick ; round the neck, where the secondary layer has been broken away, it extends to a thickness at least double the diameter of the neck on each side. Millett records the species as abundant in the Malay Archipelago and Sidebottom (*ut supra*). There are no other records, but we have specimens from Cebu, in the Philippine Islands (120 fms.).

650. *Lagena auriculata*, var. *costata*, Sidebottom.

Lagena auriculata, var. *costata*, Sidebottom, 1912, etc., LSP. 1912, p. 422, pl. xx, figs. 21, 22 ; 1913, p. 200.

A single typical specimen.

E.—WAGNERELLA BOREALIS, Meresch.

Wagnerella borealis, Mereschkowsky.

Wagnerella borealis, Mereschkowsky, Études sur les Éponges de la Mer Blanche, Mém. Ac. Imp. Sci. St. Pétersbourg, 1878, ser. vii, vol. xxvi, No. 7, p. 22, pl. ii, figs. 1–5.
„ „ Mereschkowsky, On *Wagnerella*, etc., 1878, Ann. Mag. Nat. Hist. Ser. 5, vol. i, p. 70, pl. vi.
„ „ Mayer, P., 1879, Zool. Anz. II.
„ „ Mayer, P., 1881, Zool. Anz. IV.
„ „ Zuelzer, M., 1909, Archiv für Protistenkünde, 70 Band., pp. 136–202, pl. vi–x.

Although not proper to this Report the occurrence of this remarkable genus of Heliozoa in the " Terra Nova " material is noteworthy and should be recorded.

At Official Stations 194 and 220 (our Stations 26 and 38), off Oates Land, 180–200 fms., *Wagnerella* occurs sessile on Hydrozoa and Polyzoa, and judging from the number of recognizable fragments of the tube which occur in the finest débris is probably abundant at the Station. It was not observed in any other gathering.

So far as we are competent to judge, the specimens do not differ from the figures of Mereschkowsky and Zuelzer, except that in one fragment the long cylindrical tube is densely clad over its whole length with the long spicular bodies which in the published figures are confined to the globular head.

The form was originally described from the White Sea, sessile on Sertulariae and Polyzoa at 2–16 fms. and has since been recorded from shallow water at Naples growing on stones.

No perfect specimens were found, the preparation of the material for our own purposes having been fatal to this delicate organism, but an examination of the preserved Zoophytes would probably lead to the discovery of many individuals.

VI.—LIST OF WORKS REFERRED TO IN THE REPORT.

The number of authorities referred to in the synonymies of the six hundred and fifty species described in this Monograph is so great that it has been necessary to make every effort to economise space. The principle, therefore, first adopted by us in the Clare Island Monograph, has been followed here.

Names of authors, titles of articles, and full bibliographical references to the Transactions and Proceedings in which they are to be found are given in this Bibliography, some lengthy titles being shortened, as follows :—

AMNH. = Annals and Magazine of Natural History.
JRMS. = Journal of the Royal Microscopical Society, London.
JQMC. = Journal of the Quekett Microscopical Club, London.
MASIB. = Memorie della Reale Accademia delle Scienze dell' Istituto di Bologna.
QJGS.= Quarterly Journal of the Geological Society, London.
SAWW. = Sitzungsberichte der Kaiserliche Akademie der Wissenschaften Wien. (D = Denkschrift.)

The titles of papers and books are indicated by initials only, after the date of publication, and the first letter of the author's name :—thus, C. 1892, PTC. = F. Chapman, "Microzoa from the Phosphatic Chalk of Taplow," the page, etc., only being given, and all further details being found under that initial and date in the Bibliography. In the case of long or short series of papers, the date of the first is given and the initials are followed by the year in which the paper referred to appeared : thus, M. 1898, etc. FM. 1900 = the papers of Millett's series beginning in 1898, which were published in JRMS. in 1900.

In some cases we have been compelled to fix our own dates arbitrarily—as, for instance, in some of J. Wright's papers, *e.g.*, W. 1885–6, BLP., in which the plate is lettered 1884–5. Brady, when quoting d'Orbigny's Cuba Monograph of 1839, nearly always gave the page in the Spanish edition of 1840. We have invariably given the pagination of the original French edition of 1839. When plates have two numbers, as in some of the Memoirs of the Société Géologique de France, both numbers are given, *e.g.*, T. 1878, FIR. pl. ix (xiv).

Again, much confusion has crept into synonymies by reason of the re-pagination of reprints, a practice which reaches its worst development and results in Parker & Jones' "Nomenclature of the Foraminifera" (P. & J., etc., 1859, etc., NF.) and in Schlumberger's consecutively re-paginated series of Reprints. We have endeavoured in every case to give the original page of the journal in which the papers were published.

A. 1865, NHC. T. Alcock.—Notes on Natural History Specimens lately recorded from Connemara. Proc. Lit. & Phil. Soc. Manchester, vol. iv, 1865, pp. 192–208.

de A 1893, CFP. G. A. de Amicis. Contribuzione alla conoscenza dei Foraminiferi Pliocenici. Boll. Soc. Geol. Ital. vol. xii, 1893, fasc. 3, pp. 293–478, pl. iii.

B. 1791, CS. A. J. G. K. Batsch.—Sechs Kupfertafeln mit Conchylien des Seesandes. Jena, 1791.

B. 1855, FSH. J. G. Bornemann.—Die mikroskopische Fauna des Septarienthones von Hermsdorf bei Berlin. Zeitschr. Deutch. geol. Gesellsch. vol, vii. pp. 307–371, pls. xii–xxi.

B. 1864, RFS. H. B. Brady.—Contributions to our Knowledge of the Foraminifera. On the Rhizopodal Fauna of the Shetlands. Trans. Linn. Soc. (London), vol. xxiv, pp. 463–475, pl. xlviii.

B. 1870, FTR. G. S. Brady, D. Robertson, & H. B. Brady.—The Ostracoda and Foraminifera of Tidal Rivers. AMNH. ser. 4, vol. vi, pp. 273–306, pls. xi, xii.

B. 1877, FNB. H. B. Brady.—Supplementary Note on the Foraminifera of the Chalk (?) of the New Britain Group. Geol. Mag. dec. ii, vol. iv, no. 12, pp. 534–536.

B. 1878, RRNP. H. B. Brady.—On the Reticularian and Radiolarian Rhizopoda (Foraminifera and Polycystina) of the North-Polar Expedition of 1875–76. AMNH. ser. 5, vol. i, pp. 425–440, pls. xx, xxi.

B. 1879, etc., RRC. H. B. Brady.—Notes on some of the Reticularian Rhizopoda of the "Challenger" Expedition. Quart. Journ. Micr. Sci. (London), vol. xix, pp. 20–63, pls. iii–v; pp. 261–299, pl. viii. Continued in vol. xxi, 1881, pp. 37–71.

B. 1880, EAM. G. Berthelin. — Mémoire sur les Foraminifères Fossiles de l'Étage Albien de Montcley, (Doubs.). Mém. Soc. Géol. France, ser. 3, vol. i, no. 5.

B. 1881, HNPE. H. B. Brady.—Ueber einige arktische Tiefsee-Foraminiferen, gesammelt während der österreichisch-ungarischen Nordpol-Expedition in den Jahren 1872–74. DAWW. vol. xliii (1881), pp. 91–110, pls. i, ii.

B. 1882, FKE. H. B. Brady.—Report on the Foraminifera, in Comm. Tizard and John Murray: Exploration of the Färoe Channel during the Summer of 1880 in H.M. Hired Ship, "Knight Errant." Proc. Roy. Soc. Edinb. vol. xi. pp. 708–717, pl. vi.

B. 1883. L. L. G. Bornemann.—Sopra una specie Mediterranea del Genere *Lingulinopsis*. Att. Soc. Toscana Sci. Nat. vol. vi. 1883, pp. 26–28, pl. vi.

B. & M. 1884, FG. F. P. Balkwill & F. W. Millett.—The Foraminifera of Galway. Journ. Microscopy and Nat. Sci. (London), vol. iii, pp. 19–28 & 78–90. pls. i–iv. Revision—The Recent Foraminifera of Galway, etc., by F. W. Millett (Notes and Corrections, plates re-engraved). Plymouth, 1908.

B. 1884, FC. H. B. Brady.—Report on the Scientific Results of the Voyage of H.M.S "Challenger" (Zoology), vol. ix. Report on the Foraminifera, 2 vols, 4to, text and plates London, 1884.

B. & W. 1885, DIS. F. P. Balkwill & J. Wright.—Report on some Recent Foraminifera found off the Coast of Dublin and in the Irish Sea. Trans. Roy. Irish Acad. vol. xxviii (Science), pp. 317–368, pls. xii–xiv.

B. 1887, SBRF. H. B. Brady.—Synopsis of the British Recent Foraminifera. JRMS. (London), 1887, pp. 872–927.

B. P. & J. 1888, AB. H. B. Brady, W. K. Parker, & T. R. Jones.—On some Foraminifera from the Abrolhos Bank. Trans. Zool. Soc. (London), vol. xii, pp. 211–239, pls. xl–xlvi.

B. S. & B. 1890, RC. H. W. Burrows, C. D. Sherborn, & G. Bailey.—The Foraminifera of the Red Chalk of Yorkshire, Norfolk, and Lincolnshire. JMRS. 1890, pp. 549–566, pls. viii–xi.

B. 1912, PFC. R. M. Bagg.—Pliocene and Pleistocene Foraminifera from Southern California Washington, U.S., Geol. Survey, Bull. 513.

C. 1848 NFM. J. Cornuel.—Nouveaux Fossiles Microscopiques du Terrain Crétacé Inférieur du Département de la Haute Marne. Mém. Soc. Géol. France, Ser. 2, vol. iii, 1848, Mém. 3, pp. 241-263, pls. iii, iv.

C. 1848, FWB. J. Czjzek.—Beitrag zur Kenntniss der fossilen Foraminiferen des Wiener Beckens. Haidinger's Naturwiss. Abh. (Vienna), vol. ii, pp. 137–150, pls. xii, xiii.

C. 1853, etc., PRN. O. G. Costa.—Paleontologia del Regno di Napoli, pt. ii. Atti del Accad. Pontaniana (Naples), vol. vii, pt. i, 1853, p. 105–112; pt. ii, 1856, pp. 113–378, pls. ix–xxvii.

C. 1855, FFMV. O. G. Costa.—(i) Foraminiferi Fossili della Marna Blú del Vaticano. (ii) Foraminifcri Fossili delle Marne Terziarie di Messina. Mem. Acc. Sci. (Naples), vol. ii, 1857, pp. 113–147, pls. i, ii, and pp. 367–373, pl. iii.

C. P. & J. 1862, ISF. W. B. Carpenter, W. K. Parker, & T. R. Jones.—Introduction to the Study of the Foraminifera. London, 1862. (Ray Society.)

C. 1870, HR. H. J. Carter.—On *Haliphysema ramulosa* (Bow.), and the Sponge-spicules of *Polytrema*. AMNH. ser. 4, vol. v, pp. 389–392.

C. 1877, CB. H. J. Carter.—On the Locality of *Carpenteria balaniformis*, with Description of a new Species, etc. AMNH. ser. 4, vol. xix, pp. 209–219, pl. xiii.

C. 1879, NF. H. J. Carter. Notes on Foraminifera. AMNH. scr. 5, vol. iii, pp. 407–414.

C. 1891, etc., GF. F. Chapman.—The Foraminifera of the Gault of Folkestone. JRMS. 1891, pp. 565–575; 1892, pp. 319–330, 749–758; 1893, pp. 579–595; 1894, pp. 153–163, 421–427, 645–654; 1896, pp. 1–14, 581–591; 1898, pp. 1–49.

C. 1892, PCT. F. Chapman.—Microzoa from the Phosphatic Chalk of Taplow. QJGS. vol. xlviii, pp. 514–518.

C. 1892, FS. G. W. Chaster.—Report upon the Foraminifera of the Southport Society of Natural Science District. First Rep. Southport Soc. of Nat. Sci. 1890–91 (Southport, 1892), pp. 54–72, pl. i.

C. 1895, FAS. F. Chapman.—On some Foraminifera obtained . . . from the Arabian Sea, near the Laccadive Islands. Proc. Zool. Soc. Lond. 1895, pp. 4–55, pl. i.

C. 1900, FLF. F. Chapman.—Foraminifera from the Lagoon at Funafuti. Journ. Linn. Soc. Lond. (Zoology), vol. xxviii (1902), pp. 161–210.

C. 1901, FLC. F. Chapman.—Notes on the appearance of some Foraminifera in the Living Condition from the "Challenger" Collection. Proc. Roy. Soc. Edin. vol. xxiii, 1901, pp. 391–395, pls. 1–111.

C. 1901, etc., FFA. F. Chapman.—On the Foraminifera collected round the Funafuti Atoll from shallow and moderately deep Water. Proc. Linn. Soc. Lond. (Zoology), vol. xxviii. (1902), pp. 379–433.

C. 1905, GBI. F. Chapman.—On some Foraminifera and Ostracoda obtained off Great Barrier Island, New Zealand. Trans. N.Z. Inst. vol. xxxviii (1905), pp. 77–112, pl. iii.

C. 1907, RFV. F. Chapman.—Recent Foraminifera of Victoria; some Littoral Gatherings. JQMC. ser. 2, vol. x (1909), pp. 117–146.

C. 1907, TFV. F. Chapman.—Tertiary Foraminifera of Victoria. The Balcombian Deposits of Port Philip, pt. i. Journ. Linn. Soc. Lond. (Zoology), vol. xxx (1907–1910), pp. 10–35, pls. i–iv.

C. 1909, SNZ. F. Chapman.—Report on the Foraminifera from the Sub-Antarctic Islands of New Zealand. In "Sub-Antarctic Islands of New Zealand," Wellington, N.Z., 1909, pp. 312–371.

C. 1910, etc., FNP. J. A. Cushman.—A Monograph of the Foraminifera of the North Pacific Ocean, Smithsonian Inst. U.S. Nat. Mus., Bull. 71, pt. 1, 1910; pt. 2, 1911; pt. 3, 1913; pt. 4, 1914; pt. 5, 1915; pt. 6, 1917.

C. 1909–10 SBL. F. Chapman.—A study of the Batesford Limestone. Proc. Roy. Soc. Victoria. NS. vol. xxii, pp. 263–314, pls. lii–lv.

C. 1910, FOF. F. Chapman.—On the Foraminifera and Ostracoda from soundings . . . collected round Funafuti by H.M.S. "Penguin." Journ. Linn. Soc. Lond. (Zoology). vol. xxx, 1910, pp. 388–444, pls. 54–57.

C. 1914, EDRS. F. Chapman.—Report on the Foraminifera and Ostracoda from elevated deposits on the shores of the Ross Sea. Brit. Antarct. Exp. 1907–9 (Shackleton), Geology, vol. ii, pp. 25–52. pls. i–vi.

C. 1914, FORS. F. Chapman.—Report on the Foraminifera and Ostracoda out of marine muds, from soundings in the Ross Sea. *Ibid.* pp. 53–80, pls. i–vi.

C. 1917, NFP. J. A. Cushman.—New Species and Varieties of Foraminifera from the Philippines, and adjacent waters. Proc. U.S. Nat. Mus., vol. li, pp. 651–662. (No plates.)

C. 1918, etc., FAO. J. A. Cushman.—The Foraminifera of the Atlantic Ocean. Pt. i, 1918, Pt. ii, 1920 (in progress), U.S. Nat., Mus., Bull. 104, Washington.

C. 1919, FFWI. J. A. Cushman.—Fossil Foraminifera from the West Indies. Carnegie Inst. Washington. Pub. 291, 1919, pp. 21–71, pls. i–xv.

C. 1919, RFNZ. J. A. Cushman.—Recent Foraminifera from off New Zealand. Proc. U.S. Nat. Mus., vol. lvi (1919), pp. 593–640, pls. 74, 75.

C. 1920, CAE. J. A. Cushman.—Report of the Canadian Arctic Expedition, 1913–18, vol. ix, pt. M, Foraminifera, Ottawa, 1920, pp. 12, pl. i.

D. 1906, FC. W. J. Dakin.—Report on the Foraminifera collected by Prof. Herdman at Ceylon in 1902. Ceylon Pearl-Oyster Fisheries. Suppl. Reports, pt. v, no. xxxvi, pp. 225–242.

E. 1841, SNA. C. G. Ehrenberg.—Verbreitung und Einfluss des mikroskopischen Lebens in Süd- und Nord-Amerika. Abhandl. kgl. Akad. der Wiss. (Berlin), 1843 (for 1841), pp. 291–446, pls. i–iv, and Bericht, pp. 139–142, with Appendix, pp. 202–209.

E. 1843, MMO. C. G. Ehrenberg.—Neue Beobachtungen über den sichtlichen Einfluss der mikroskopischen Meeres-Organismen, auf den Boden des Elb-bettes bis oberhalb Hamburg (Berlin), 1843, Ber. k. preuss. Ak. Wiss., pp. 161–167.

E. 1854, M. C. G. Ehrenberg.—Mikrogeologie. Das Wirken des unsichtbaren kleinen Lebens auf der Erde. Leipzig, 1854.

E. 1857, MSO. J. G. Egger.—Die Foraminiferen der Miocän-Schichten bei Ortenburg in Nieder-Bayern, Neu. Jahrb. Mineral., etc. (Stuttgart), 1857, pp. 266–311, pls. v–xv.

E. 1873, LMT. C. G. Ehrenberg.—Mikrogeologische Studien über das kleinste Leben der Meeres-Tiefgründe aller Zonen und dessen geologischen Einfluss. Abhandl. kgl. Akad. Wiss. (Berlin), 1872 (1873), pp. 131–397, pls. i–xii, and map.

E. 1893, FG. J. G. Egger.—Foraminiferen aus Meeresgrundproben, gelothet von 1874 bis 1876, von S.M.Sch. "Gazelle." Abhandl. kgl. bayerisch. Akad. Wiss. (Munich), ii Cl. vol. xviii, pt. 2, pp. 195–458, pls. i–xxi.

E. 1899, KOA. J. G. Egger.—Foraminiferen und Ostrakoden aus den Kreidemergeln der Oberbayerischen Alpen. Abhandl. kgl. bayerisch. Akad. Wiss. (Munich), ii Cl. vol. xxi, pt. i.

E. 1905, FBS. A. Earland.—The Foraminifera of the Shore Sand at Bognor, Sussex. JQMC. ser. 2, vol. ix, no. 57, pp. 187–232.

E. 1910, FKR. J G. Egger.—Ostrakoden und Foraminiferen des Eybrunner Kreidemergels in der Umgegend von Regensburg. Ber. naturwiss. Ver. Regensburg, xii, Jahre. 1907–9 (reprint), pp. 48, pls. i–vi.

F. & M. 1798, TM. L. von Fichtel & J. P. C. von Moll.—Testacea Microscopica aliaque minuta ex generibus Argonauta et Nautilus ad naturam picta et descripta . . . . cum 24 tabulis aeri incisis coloratis. Vienna, 1798. (Second issue, 1803.)

de F. 1881, RRT. L. (Marquis) de Folin.—Exploration du Travailleur, 1880. Rhizopodes Réticulaires. Bull. Soc. Hist. Nat. Toulouse, vol. xv, 1881, pp. 130–141.

F. 1883, FPS. C. Fornasini.—Nota preliminare sui Foraminiferi della marna pliocenica del Ponticello di Savena nel Bolognese. Boll. Soc. Geol. Ital., vol. ii, fasc. 2, 1883, pp. 176–190, pl. ii.

F. 1887, B. L. (Marquis) de Folin.—Les Bathysiphons, premières pages d'une Monographie du Genre. Actes. Soc. Linn. Bordeaux, vol. xl, 1887, pt. v, pp 271–291; pt. 6, 1888, pls. v–viii.

de F. 1887, RR. L. (Marquis) de Folin.—Les Rhizopodes Réticulaires. Le Naturaliste (Paris), 1887, pp. 102–3; 113–15; 127–8; 139–40; Figs. 1–20 in text, etc. (1888).

F. 1887, ITI. C. Fornasini.—Indice delle Textularie Italiane. Boll. Soc. Geol. Ital. vol. vi, p. 387, etc., pl. x.

de F. 1895, SRR. L. (Marquis) de Folin.—Aperçus sur le Sarcode des Rhizopodes réticulaires. Bull. Soc. Hist. Nat. Colmar, 1895–6 (reprint, pp. 25), pl. o.

F. 1896, TC. C. Fornasini.—Di alcune forme Plioceniche della *Textularia candeiana* e della *T. concava*. MASIB. scr. 5, vol. vi, pp. 3–8.

F. 1899, RFA. J. M. Flint.—Recent Foraminifera. A Descriptive Catalogue of Specimens dredged by the U.S. Fish Commission Steamer "Albatross." Washington, U.S.A., 1899. (Smithsonian Institution.)

F. 1913–14, FMAF. E. Fauré-Fremiet.—Les Foraminifères de la seconde Mission Antarctique Française IIe campagne du "Pourquoi Pas" (Note Préliminaire). Bull. Soc. Géol. France, vol. xxxviii, 1913, pp. 260–271. Text-figs.

[This was reprinted with very slight alterations and additions in the official volume "Deuxième Expédition Antarctique Française (1908–1910) Foraminifères Par E. Fauré Fremiet" (Paris, 1914), 16 pp., 1 pl. The text-figures are redrawn and better reproduced by photo-lithography on the plate.]

G. 1781, ZG. L. T. Gronovius.—Zoophylacium Gronovianum exhibens Animalia, Quadrupeda, etc. Leyden, 1781.

G. 1882, RRCS. A. Goës.—On the Reticularian Rhizopoda of the Caribbean Sea. K. Svenska Vet. Akad. Handl., vol. xix, no. 4 (Stockholm, 1882), pp. 1–151, pls. i–xii.

G. 1894, FMDT. R. J. L. Guppy.—On some Foraminifera from the Microzoic Deposits of Trinidad, W.I. Proc. Zool. Soc. Lond. 1894, pp. 647–653, pl. xli.

G. 1894, ASF. A. Goës.—A Synopsis of the Arctic and Scandinavian recent Marine Foraminifera hitherto discovered. K. Svenska Vet.-Akad. Handl. Stockholm, vol. xxv, no. 9.

G. 1896, DOA. A. Goës.—Reports on the Dredging Operations off the West Coast of Central America, etc., carried on by the U.S. Fish-Commission Steamer "Alabatross," etc. Bull. Mus. Comp. Zool. Harvard, vol. xxix, no. 1. Cambridge, Mass. 1896.

G. 1901, OWI. J. Grzybowski.—Otwornice warstw inoceramowych okolicy Gorlic. Rozpraw Wydz. mat.-przyrod. Ak. Umiej. w Krakowie, ser. B, vol. xli, 1901. pp. 219–288, pls. vii, viii.

H. 1875, CSS. M. von Hankten.—Die Fauna der Clavulina Szaboi Schichten.—I. Foraminiferen. Mitth. Jahrb. kgl. ungarisch. geolog. Anstalt (Buda Pesth), vol. iv, 1875 (1881), pp. 1–93, pls. i–xvi.

H. 1883, ALB. R. Haeusler.—Die Astrorhiziden und Lituoliden der Bimammatus-zone. Neues Jahrb. Min. vol. i, pp. 55–61. (See also "Notes on some Upper Jurassic Astrorhizidæ and Lituolidæ." QJGS. 1883, vol. xxxix, pp. 25–29, pls. ii, iii.)

H. 1885, LAI. R. Haeusler.—Die Lituolidenfauna der aargauischen Impressaschichten. Neues Jahrb. Mineral. Beilägeband iv, pp. 1–30, pls. i–iii.

H. 1888, ACF. W. Howchin.—Additions to the knowledge of the Carboniferous Foraminifera. JRMS. 1888, pp. 533–545 pls. viii, ix.

H. 1890, FST. R. Haeusler.—Monographie der Foraminiferenfauna der Schweizerischen Transversariuszone. Abh. Schweiz. Paläont. Ges., vol. xvii, pp. 1–135, pls. i–xv.

H.-A. & E. 1908, etc., SB. E. Heron-Allen & A. Earland.—The Recent and Fossil Foraminifera of the Shore Sands at Selsey Bill, Sussex. JRMS. 1908, pp. 529–543; 1909, pp. 306–336, 422–446, 677–698; 1910, pp. 401–426, 693–695; 1911, pp. 298–343, 436–448.

H.-A. & E. 1909, TNS. E. Heron-Allen & A. Earland.—On a new Species of *Technitella* from the North Sea, with some Observations on Selective Power as exercised by certain Species of Arenaceous Foraminifera. JQMC. ser. 2, vol. x, pp. 403–412, pls. xxxi–xxxv.

H.-A. & E. 1910, NBF. E. Heron-Allen & A. Earland.—Notes on British Foraminifera. "Knowledge," vol. xxxiii, pp. 285–286, 304–306, 376–379, 421–425.

H. 1911, P. S. J. Hickson.—On *Polytrema* and some allied Genera, etc. Trans. Linn. Soc. Lond. (Zoology), ser. 2, vol. xiv, pp. 443–462, pls. xxx–xxxii.

H.-A. & E. 1912, etc., NSG. E. Heron-Allen & A. Earland.—On some Foraminifera from the North Sea, dredged by the Fisheries Cruiser "Goldseeker." (Internat. North Sea Invest.—Scotland.)

JRMS. No. 1. New Astrorhizidae, 1912, pp. 382–389, pls. v–vii.

No. 2. *Saccammina* and *Psammosphaera*, 1913, pp. 1–26, pls. i–iv.

No. 3. *Cornuspira diffusa*, 1913, pp. 272–276, pl. xii.

No. 4. *Nouria rugosa*, 1917, pp. 361–364, pl. xxiii.

No. 5. *Thurammina papillata*, 1917, pp. 530–557, pls. xxvi–xxx.

H.-A. & E. 1913, CI. E. Heron-Allen & A. Earland.—Clare Island Survey, pt. 64. Foraminifera. Proc. R. Irish Aead. vol. xxxi, pt. 64.

H.-A. & E. 1913, FNS. E. Heron-Allen & A. Earland.—On some Foraminifera from the North Sea dredged by the Fisheries Cruiser "Huxley." JQMC. ser. 2, vol. xii, pp. 121-138.

H.-A. & E. 1914, etc., FKA. E. Heron-Allen & A. Earland.—On the Foraminifera of the Kerimba Archipelago, etc. Trans. Zool. Soc. Lond. pt. i, vol. xx, pp. 363–390, pls. xxxv–xxxvii; pt. ii, vol. xx, pp. 543–794, pls. xl–liii.

H.-A. 1915, RPF. E. Heron-Allen.—Contributions to the Study of the Bionomies and Reproductive Proeesses of the Foraminifera. Phil. Trans. Roy. Soc. (London) B, vol. 206, 1915, pp. 227–279, pls. xiii–xviii.

H.-A. & E. 1916, FSC. E. Heron-Allen & A. Earland.—The Foraminifera of the Shore Sands and Shallow Water Zone of the South Coast of Cornwall. JRMS. 1916, pp. 29–55, pls. v–ix.

H.-A. & E. 1916, FWS. E. Heron-Allen & A. Earland. Foraminifera of the West of Scotland (S.Y. "Runa," 1913). Trans. Linn. Soe. Lond. (Zoology) vol. xi (1916), pp. 197–300, pls. xxxix–xliv.

H. 1919, BMB. E. Halkyard.—The Fossil Foraminifera of the Blue Marl of the Côte des Basques, Biarritz (Edited by E. Heron-Allen & A. Earland). Mem. Proc. Manehester. Lit. & Phil. Soe. vol. lxii, 1917, no. 6, pp. 153, pls. i–viii and map.

H.-A. & E. 1920, VP. E. Heron-Allen & A. Earland.—An experimental study of the Foraminiferal speeies *Verneuilina polystropha* (Reuss), etc. Proe. R. Irish Acad. vol. xxxv B, no. 8, pp. 153–177, pls. xvi–xviii.

J. & P. 1860, FCD. T. Rupert Jones & W. K. Parker.—On some Fossil Foraminifera from Chellaston, near Derby. QJGS. vol. xvi, pp. 452–458.

J & P. 1860, RFM. T. Rupert Jones & W. K. Parker.—On the Rhizopodal Fauna of the Mediterranean compared with that of the Italian and some other Tertiary Deposits. QJGS. vol. xvi, pp. 292–307, and table.

J. & P. 1863, FJ. T. R. Jones & W. K. Parker.—Notes on some Fossil and Reeent Foraminifera eolleeted in Jamaica by the late Lueas Barrett. Rep. Brit. Ass. Neweastle, 1863 (Lond. 1864), p. 80.

J. P. & B. 1866, etc., MFC. T. R. Jones, W. K. Parker, H. B. Brady (and others). — Monograph of the Foraminifera of the Crag. London, 1866–1897 (Palæolontographical Soc.), pt. i, 1866, pp. 1–72; pt. ii, 1895, pp. 73–210; pt. iii, 1896, pp. 211–314; pt. iv, 1897, pp. 315-402.

J. 1872, LJS. F. W. O. Rymer Jones.—On some Recent Forms of Lagenae from Deep-sea Soundings in the Java Sea. Trans. Linn. Soc. Lond. (Zoology), vol. xxx, pp. 45–69.

J. & C. 1896–8, FPR. T. R. Jones & F. Chapman.—On the Fistulose *Polymorphinae*, and on the Genus *Ramulina*. Journ. Linn. Soe. Lond. (Zoology), part i, vol. xxv, pp. 496–516; part ii, vol. xxvi, 1898, pp. 334–352.

J. & C. 1900, MCI. T. Rupert Jones & F. Chapman.—In "A Monograph of Christmas Island," pp. 226–264. London (Brit. Mus.), 1900.

K. 1865, FWS. F. Karrer.—Ueber das Auftreten von Foraminifera in den älteren Sehiehten des Wiener Sandsteins. SAWW. 1866, vol. lii, pp. 492–497, pl. o.

K. 1868, MFKB. F. Karrer.—Die Mioeene Foraminiferenfauna von Kostej im Banat. SAWW. vol. lviii, Abth. i, pp. 111–193, pls. i–v.

K. 1877, HW. F. Karrer.—Geologie der Kaiser Franz Josefs Hoehquellen-Wasserleitung. Abh. K. K. Geol. Reiehsanst. vol. ix, Vienna, 1877.

K. 1878, FTTL. F. Karrer.—Die Foraminiferen der Tertiären Thone von Luzon. In Dr. v. Drasehe "Fragmente zu eine Geologie der Insel Luzon." Vienna, 1878, pp. 75–99, pl. v.

K. 1899, NNAE. H. Kiaer. Norwegian North-Atlantie Expedition 1876–8, Zoology. Thalamophora. Christiania, 1899, 15 pp. pl. i and map.

L. 1767, etc., SN. C. von Linné.—Systema Naturae. Edn. xii, Leipzig, 1767; edn. xiii by J. F. Gmelin, Leipzig, 1788–93.

L. 1804, etc., AM. J. B. P. A. de M. de Lamarck.—Suite des Mémoires sur les Fossiles des Environs de Paris. (Explication des Planches rélatives aux Coquilles Fossiles des Environs de Paris.) Ann. Mus. (Paris), vol. v, 1804, pp. 179–180, 237–245, 349–357. Continued in vol. viii, 1806, pp. 383–387, pl. 62, and vol. ix, 1807, pp. 236–240, pl. 17.

L. 1816, etc., ASV. J. B. P. A. de M. de Lamarck.—Histoire Naturelle des Animaux sans Vertèbres, vol. ii (Paris, 1816), pp. 193–197; vol. vii (Paris, 1822), pp. 580–632; 2nd edn., Paris, 1835–45 (11 vols.).

L. 1902, EOM. A. Liebus.—Ergebnisse einer mikroskopischen Untersuchung der organischen Einschlüsse der oberbayrischen Molasse. Jahrb. k.k. Geol. Reichsanst. Vienna, 1902, vol. lii, pp. 71–106, pl. v.

M. 1843, HMAA. W. Macgillivray.—A History of the Molluscous Animals of the Counties of Aberdeen, etc. London, 1843.

M. 1803–8, TB. G. Montagu.—Testacea Britannica, or Natural History of British Shells. In 3 vols. 4to. London, 1803. Supplement (Plates), 1808.

M. 1808–10, CS. D. de Montfort.—Conchyliologie Systématique et Classification Méthodique des Coquilles, etc., 2 vols. Paris, 1808–1810.

M. 1880, FM. K. Möbius.—In Möbius, Richter, & von Martens's "Beiträge zur Meeresfauna der Insel Mauritius und der Seychellen. Foraminifera von Mauritius." Pp. 63–110, pls. i–xiv. Berlin, 1880.

M. 1885, etc., StE. F. W. Millett.—The Foraminifera of the Pliocene Beds of St. Erth (Cornwall). Trans. R. Geol. Soc. Cornwall, 1885, vol. x, pp. 213–216 pp. 222–226, 1894, vol. xi, pp. 655–661, pl. o; 1896, vol. xii, pp. 43–46; 1898, vol. xii, pp. 174–176, pl. o; 1902, vol. xii, pp. 719–720.

M. 1895, FDH. V. Madsen.—Istidens Foraminiferer i Danmark og Holsten. Medd. Dansk. Geol. Foren. no. 2. Copenhagen, 1895.

M. 1898, etc., FM. F. W. Millett.—Report on the Recent Foraminifera of the Malay Archipelago contained in Anchor-Mud, collected by Mr. A. Durrand, F.R.M.S. JRMS. 1898, pp. 258–269, 499–513, 607–614; 1899, pp. 249–255, 357–365, 557–564; 1900, pp. 6–13, 273–281, 539–549; 1901, pp. 1–11, 485–497, 619–628; 1902, pp. 509–528; 1903, pp. 253–275, 685–704; 1904, pp. 489–506, 597–609.

N. 1850, etc., FOL. J. L. Neugeboren.—Foraminiferen von Felso und Ober-Lapugy, etc., Verh. u. Mitth. des Siebenb. Vereins f. Naturwiss zu Hermannstadt, 1850, pp. 45–48 pl. i; pp. 118–127, pls. iii, iv; pp. 163–171, 1851, pp. 118–135; pp. 140–145, pl. iv; 1852, pp. 34–59, pl. i.

N. 1856, OLS. J. L. Neugeboren.—Die Foraminiferen aus der Ordnung der Stichosteger von Ober-Lapugy in Siebenburgen. DAWW. vol. xii, 1856, pp. 65–100, pls.; i–v.

N. 1878, GH. A. M. Norman.—On the Genus *Haliphysema* with description of several forms apparently allied to it. AMNH, ser. 5, vol. i, pp. 265–284, pl. xvi.

d'O. 1826, TMC. A. D. d'Orbigny.—Tableau Méthodique de la Classe des Céphalopodes. Ann. Sci. Nat. (Paris), vol. vii, pp. 245–314, pls. x–xvii.

d'O. 1826 (Modèles). A. D. d'Orbigny.—Modèles de Céphalopodes Microscopiques vivants et fossiles représentant un individu de chacun des genres et des sous-genres de ces Coquilles. Paris, 1826 (2nd issue, with new Catalogue, 1843).

d'O. 1839, FAM. A. D. d'Orbigny.—Voyage dans l'Amérique Méridionale, vol. v, pt. 5. Foraminifères. Paris, 1839.

d'O. 1839, FC. A. D. d'Orbigny.—Foraminifères. In Ramon de la Sagra: Histoire Physique, Politique et Naturelle de l'Île de Cuba. Text 8vo and plates fol. Paris, 1839, (Spanish edn., Paris, 1840).

d'O. 1839, FIC. A. D. d'Orbigny.—Foraminifères. In Barker-Webb & Berthelot: Histoire Naturelle des Îles Canaries, vol. ii, pt. 2, pp. 119–146, 3 pls. Paris, 1839.

d'O. 1840, CBP. A. D. d'Orbigny.—Mémoire sur les Foraminifères de la Craie Blanche du Bassin de Paris. Mém. Soc. Géol. France, vol. iv, pp. 1–51, pls. i–iv.

d'O. 1846, FFV. A. D. d'Orbigny.—Foraminifères Fossiles du Bassin Tertiaire de Vienne. 4to. 21 plates. Paris, 1846.

d'O. 1850, etc., PP. A. D. d'Orbigny.—Prodrome de Paléontologie stratigraphique universelle des Animaux mollusques et rayonnés. Paris. Vol. i, 1849; vol. ii, 50; vol. iii, 1852.

P. 1844, EMS. R. A. Philippi.—Enumeratio Molluscorum Siciliae cum viventium tum in tellure tertiaria fossilium. Vol. ii. Halle (Halis Saxorum), 1844.

P. & J. 1857, FCN. W. K. Parker & T. Rupert Jones.—Description of some Foraminifera from the Coast of Norway. AMNH. ser, 2, vol. xix, pp. 273–307, pls. x, xi.

P. & J., etc. 1859, etc., NF. W. K. Parker, T. R. Jones, H. B. Brady, & J. W. Kirby.—On the Nomenclature of the Foraminifera. AMNH. 1859–1872. (*In* 16 *parts*).

P. 1870, GStL. W. K. Parker. (In G. M. Dawson).—On Foraminifera from the Gulf and River St. Lawrence. Canadian Nat. (Montreal), NS, vol. v, p. 172. Amer. Journ. Sci. (New Haven, Conn.), ser. 3, vol. i, 1871, pp. 204–210; AMNH (London), ser. 4, vol. vii, 1871, pp. 83–89.

P. & J. 1865, NAAF. W. K. Parker & T. R. Jones.—On some Foraminifera from the North Atlantic and Arctic Oceans, including Davis Straits and Baffin's Bay. Phil. Trans. Roy. Soc. (London), vol. clv. pp. 325–441, pls. xii–xix.

P. 1900, RCA. F. Pearcey.—On some deep sea Rhizopods found in the Clyde Area. Millport Biol. Stn. Comm. 1, 1900, pp. 37–42, pls. i, ii.

P. 1913, SNA. J. H. Harvey Pirie.—Scottish National Antarctic Expedition, 1902-04; Deep Sea Deposits. Trans. Roy. Soc. Edin. vol. xlix, 1913, pt. 3, no. 10, pp. 645–686. Maps.

P. 1914, SNA. F. G. Pearcey.—Foraminifera of the Scottish National Antarctic Expedition. Trans. Roy. Soc. Edin. vol. xlix (1914), pp. 991–1044, pls. i–ii.

R. 1838, CNTM. F. A Roemer.—Die Cephalopoden des nord-deutschen tertiären Meeressandes. N. Jahrb. f. Min., etc., Stuttgart, 1838, pp. 381–394, pl. iii.

R. 1845–6, VBK. A. E. Reuss.—Die Versteinerungen der böhmischen Kreideformation. Stuttgart, 4to, 1845–6.

R. 1849–50, FOT.* A. E. Reuss.—Neue Foraminiferen aus den Schichten des oesterreichischen Tertiärbeckens. Denkschr. Math. Naturwiss. Kl. k. Akad. Wiss. (Vienna), vol. i, 1850, pp. 365–390, pls. xlvi–li.

R. 1851, FKL. A. E. Reuss.—Die Foraminiferen und Entomostraceen des Kreidemergels von Lemberg. Haidinger's Naturw. Abhandl. vol. iv, pp. 17–52, pls. viii, ix.

R. 1851, FSUB. A. E. Reuss.—Ueber die Fossilen Foraminiferen, etc., der Septarienthone der Umgegend von Berlin. Zeitschr. Deutsch. geol. Ges. (Berlin), vol. iii, pp. 49–92, pls. iii–vii.

R. 1852, SFL. A. E. Reuss.—Die Foraminiferen aus dem Septarienthon des Forts Leopold bei Stettin. Zeitschr. Deutsch geol. Ges. vol. iv, 1852, pp. 16–19. Text-figs.

R. 1855, KKM. A. E. Reuss.—Ein Beitrag zur genaueren Kenntniss der Kreidegebilde Meklenburgs. Zeitschr. Deutsch. geol. Ges. (Berlin), vol. vii, pp. 261–292, pls. viii–xi.

R. 1858, FP. A. E. Reuss.—Ueber die Foraminiferen von Pietzpuhl. Zeitschr. Deutsch. geol. Ges. vol. x, pp. 433–438.

R. 1861, FKM. A. E. Reuss.—Die Foraminiferen des Kreidetuffs von Maestricht. SAWW. vol. xliv, pp. 304–324, pls. i–viii.

R. 1862, FFL. A. E. Reuss.—Die Foraminiferen-Familie der Lagenideen. SAWW. math-naturw. Kl. vol. xlvi, Abth. i, 1862 (1863), pp. 305–342, pls. i–vii.

R. 1862, NHG. A. E. Reuss.—Die Foraminiferen des Norddeutschen Hils und Gault. SAWW. math-naturw. Kl. vol. xlvi, Abth. i (1863), pp. 5–100, pls. i–xiii.

R. 1863, FCA. A. E. Reuss.—Les Foraminifères du Crag d'Anvers. Bull. Acad. Roy. Belge (Brussels), ser. 2, vol. xv, pp. 137–162, pls. i–iii.

R. 1863–4, KTF. A. E. Reuss.—Beiträge zur Kenntniss der tertiären Foraminiferen-fauna (Zweite Folge). III. Die Foraminiferen des Septarienthones von Offenbach. IV. Die Foraminiferen des Septarienthones von Kreuznach. SAWW. vol. xlviii (1864), pp. 36–71, pls. i–viii.

[* This paper is variously referred to as being dated 1849 and 1850. It was read in May, 1849, and all the separate copies were dated on a special title-page 1849, but the volume of which it forms part was issued in 1850 and is so dated.]

R. 1865–6, FABS. A. E. Reuss.—Die Foraminiferen, Anthozoen, und Bryozoen des Deutschen Septarienthones. DAWW. vol. xxv (1865), pp. 117–214, pls. i–xi.

R. 1869, FOG. A. E. Reuss.—Zur fossile Fauna der Oligocänschichten von Gaas. SAWW. vol. lix, Abth. i, pp. 446–486, pls. i–vi.

R. 1870, FSP. A. E. Reuss.—Die Foraminiferen des Septarienthones von Pietzpuhl. SAWW. vol. lxii, Abth. i, pp. 455–493. *Plates*, see S. 1870, FSP.

R. 1903, ZRR. L. Rhumbler.—Systematische Zusammenstellung der recenten Reticulosa. Arch. Protistenk., Jena, vol. iii, pp. 181–294.

R. 1905, MF. L. Rhumbler.—Mitteilung über Foraminiferen. Verh. Deutsch. Zool. Ges. 1905, pp. 97–106. Figs. 1–9.

R. 1906, FLC. L. Rhumbler.—Foraminiferen von Laysan und den Chatham Inseln. Spengel's Zool. Jahrb. Abt. Syst., vol. xxiv, pt. i, pp. 21–80, pls. i–v.

R. 1909, etc., FPE. L. Rhumbler.—Die Foraminiferen (Thalamophoren) der Plankton Expedition. (Ergebnisse der Plankton Expedition der Humboldt-Stiftung, vol. iii, L. c.) Kiel and Leipzig. Pt. i, 1909; pt. ii, 1913.

S. 1854, OP. M. S. Schultze.—Ueber den Organismus der Polythalamien (Foraminiferen) nebst Bemerkungen über die Rhizopoden in Allgemeinen. Leipzig, 1854.

S. 1862, FMMM. G. Seguenza.—Descrizione dei Foraminiferi Monotalamici delle Marne Mioceniche del Distretto di Messina. Messina, 1862.

S. 1862, RFC. G. Seguenza.—Prime richerche intorno ai Rizopodi fossili dellc Argille Pleistoceniche dei dintorni di Catania. Att. Acc. Gioenia Sci. Nat. ser. 2, vol. xviii, pp. 85–126, pls. i–iii.

S. 1866, FKN. C. Schwager.—Fossile Foraminiferen von Kar Nicobar. Novara-Expedition. Geol. Theil. vol. ii, pp. 187–268, pls. iv–vii. Vienna, 1866.

S. 1867, ZSW. E. E. Schmid.—Ueber die Kleineren organischen Formen des Zechsteinkalks von Selters in der Wetterau. Neues Jahrb. Min. 1867, pp. 576–588, pl. vi.

S. 1867, ZAS. C. Schwager.—Foraminiferen aus der Zone des Amm. Sowerbyi (Unter-Oolith) (in Waagen Z.A.S.) Benecke's geogn.-pal. Beiträge, vol. i, pt. 3, pp. 654–661, pl. 34 (xi).

S. 1868, LUHD. M. Sars.—Fortsatte Bemaerkninger over det dyriske Livs Udbredning i Havets Dybder. Forhandlingar. Vid. Selsk. Christiania (1869), pp. 246–275. AMNH (London), ser 4, vol. iii, pp. 423–444.

S. 1870, FSP. E. von Schlicht.—Die Foraminiferen des Septaricnthones von Pietzpuhl. Berlin, 1870.

S. 1872, NFVI. O. Silvestri.—(Le Nodosarie fossili nel Terreno sub-appenino Italiano, e viventi nei mari d'Italia.) Monografia delle Nodosarie. Atti Accad. Gioenia Sci. Nat. (Catania), ser. 3, vol. vii, pp. 1–108, pls. i–xi.

S. 1874, R. F. E. Schulze.—Zoologische Ergebnisse der Nordseefahrt vom 21 Juli bis 9 September, 1872. I. Rhizopoden. II. Jahresber. Komm. Unt. d. deutschen Meere in Kiel (Berlin), pp. 99–114, pl. ii.

S. 1878, FRD. J. D. Siddall.—The Foraminifera of the River Dee. Proc. Chester Soc. Nat. Sci., no. 2, pp. 42–56, figs.

S. 1879–80, FTR. G. Seguenza.—Le Formazione Terziarie nella Provincia di Reggio (Calabria) Att. R. Acc. Lincei, ser. 3, vol. vi, pp. 1–466, pls. i–xvii.

S. 1882, CMIM. G. Seguenza.—Studi geologici e paleontologici sul Cretaceo media dell' Italia Meridionale. Att. R. Ac. Linc., ser. 3, vol. xii, 1882, pp. 65–214, pls. i–xxi.

S. 1883, ELW. C. Schwager.—Die Foraminiferen aus den Eocänablagerungen der libyschen Wuste und Ægyptens. Paleontographica (Cassel), vol. xxx, 1883, pp. 81–153, pls. xxiv–xxix.

S. & C. 1886, MLC. C. D. Sherborn & F. Chapman.—On some Microzoa from the London Clay exposed in the Drainage Works, Piccadilly, London, 1885. JRMS. 1886, pp. 737–763, pls. xiv–xvi. Additional Note: JRMS. 1889, pp. 483–488, pl. xi.

S. 1886, LMBC. J. D. Siddall.—Report on the Foraminifera of the L(iverpool) M(arine) B(iology) C(ommittee) District. LMBC. Report No. 1. Proc. Lit. Phil. Soc. Liverpool, no. xl, Appendix, pp. 42–71, pl. i.

S. 1887, P. C. Schlumberger.—Note sur le genre *Planispirina*. Bull. Soc. Zool. France, vol. xii, pp. 475–488 (pp. 105–118 in the Reprints), pl. vii and figs.

S. 1891, BGF. C. Schlumberger.—Révision des Biloculines des Grands Fonds. Mém. Soc. Géol. France, vol. iv, pp. 542–579 (pp. 155–198 in the Reprints), pls. ix–xii.

S. 1892, FAM. C. Schlumberger. Note Préliminaire sur les Foraminifères draguées par S. A. le Prince Albert de Monaco. Mém Soc. Zool. France, vol. v, pp. 207–212 (pp. 193–198 in the Reprints), pl. viii.

S. 1893, MGM. C. Schlumberger.—Monographie des Miliolidées du Golfe de Marseilles. Mém. Soc. Zool. France, vol. vi, pp. 57–80 (pp. 199–228 in the Reprints), pls. ii–iv.

S. 1896, etc., FPS. A. Silvestri.—Foraminiferi pliocenici della provincia di Siena. (pt. ii), Mem. Pont. Acc. N. Lincei. Pt. i, vol. xii, 1896, pp. 1–204, pls. i–v; pt. ii, vol. xv, 1899, pp. 155–381, pls. vi–xi.

S. 1902, LMT. A. Silvestri.—Lageninc del Mar Tirreno. Mem. Pont. Accad. Nuovi Lincei (Romc), vol. xix, pp. 133–172.

S. 1903, PM. A. Silvestri.—Forme nuove o poco conosciute di Protozoi Miocenici Picmontesi. Acc. R. Sci. Torino, vol. xxxix, 1903, pp. 14 (reprint).

S. 1904, etc., RFD. H. Sidebottom.—Report on the Recent Foraminifera from the Coast of thc Island of Delos (Grecian Archipelago). Mem. Manchester Lit. and Phil. Soc. (Manchester), pt. 1, vol. xlviii, 1904, no 5; pt. 2, vol. xlix, 1905, no. 5; pt. 3, vol. l, 1906, no. 5; pt. 4, vol. li, 1907, no. 9; pt. 5, vol. lii, 1908, no. 13; pt. 6, vol. liii, 1909, no. 21.

S. 1904, TB. A. Silvestri.—Richerche strutturali su alcunc forme dei Trubi di Bonfornello (Palermo). Mem. Pont. Acc. Nuovi Lincei, vol. xxii, pp. 235–276, figs.

S. 1910, RFBP. H. Sidebottom.—Report on the Recent Foraminifera from the Bay of Palermo (Sicily), 14–20 fms. Mem. Proc. Manchester Lit. & Phil. Soc., vol. liv, pt. 3, no. 16.

S. 1912, etc., LSP. H. Sidebottom.—Lagenae of the South-west Pacific Ocean, from Soundings takcn by H.M.S. "Waterwitch," 1895. JQMC. scr. 2, vol. xi, no. 70, pp. 375–434, pls. xiv–xxi, Supplementary Paper: JQMC. scr. 2, vol. xii, 1913, no. 73, pp. 161–210, pls. xv–xviii.

S. 1918, FECA. H. Sidebottom.—Report on the Recent Foraminifera dredged off the East Coast of Australia. H.M.S. "Dart," Station 19. JRMS. 1918, pp. 1–25, pls. i, ii; pp. 121–153, pls. iii–v; pp. 249–264, pl. vi.

T. 1858, etc., FLM. O. Terquem.—Mémoires sur lcs Foraminifères du Lias du Département de la Moselle. Mém. Ac. imp. Metz (i). vols. xxxix–lii, 1858–1883.

T. 1868, etc., FOM. O. Terquem.—Mémoires sur les Foraminifères du Système Oolithique (Reprints) Mém. Ac. imp. Metz, pt. i, vols. xi–lii, 1868–1870; pt. 4, Metz, 1874, pp. 279–338 (Reprint series) pls. xxx–xxxvii; pt. 5, Paris, 1883, pp. 339–406 (Reprint series), pls. xxxviii–xlv.

T. 1875, etc., APD. O. Terquem.—Essai sur le Classcment des Animaux qui vivent sur la Plage et dans les Environs de Dunkerque. Paris pt. 1, 1875, pp. 1–54, pls. i–vi; pt. 2, 1876, pp. 55–100, pls. vii–xii; pt. 3, 1881, pp. 101–152, pls. xiii–xvii.

T. 1878, FIR. O. Terquem.—Les Foraminifères, etc., du Pliocène Supérieur de l'Ile de Rhodes. Mém. Soc. Géol. France, sér. 3, vol. i, Mém. iii.

T. 1880, SGP. G. Terrigi.—Fauna Vaticana a Foraminiferi delle Sabbie Gialle nel Plioceno sub-appenino superiore. Atti Accad. Pont. Nuovi Lincci, vol. xxxiii, pp. 127–219, pls. i–iv.

T. 1882, FEP. O. Terquem.—Les Foraminifères de l'Eocène des Environs de Paris. Mém. Soc. Géol. France, sér. 3, vol. ii, Mém. 3.

W. & B., 1784, TMR. G. Walker & W. Boys.—Testacea Minuta Rariora, etc. London, n. d. [1784].

W. & J., 1798, AEM. G. Walker & E. Jacob.—In G. Adams: Essays on the Microscope. F. Kanmacher's (2nd) Edition. (Plates copied from W. & B. 1784, and named by E. Jacob.) London, 1798.

W. 1848, BSGL. W. C. Williamson.—On the Recent British Species of the Genus *Lagena*. AMNH. ser. 2, vol. i, pp. 1–20, pls. i–ii.

W. 1858, RFGB. W. C. Williamson.—On the Recent Foraminifera of Great Britain. London, 1858 (Ray Society).

W. 1880, NEI. J. Wright.—The Post-Tertiary Foraminifera of the North-east of Ireland. Proc. Belfast Nat. Field Club, 1870–1880 (1881). Appendix, pp. 149–163.

W. 1885–6, KH. J. Wright.—The Cretaceous Foraminifera of Keady Hill, Co. Derry. Proc. Belfast Naturalists' F. Club. Appendix 1885–6, pp. 327–332, pl. xxvii.

W. 1885–6, BLP. J. Wright.—Foraminifera of the Belfast Naturalists' Field Club's Cruise off Belfast Lough in the Steam Tug "Protector," June, 1885; also, Foraminifera found by Dr. Malcomson at Rockport, Belfast Lough. Rep. Belfast Nat. Field Club, 1885–6, Appendix, pp. 317–326, pl. xxvi.

W. 1886, SWI. J. Wright.—Report on the Marine Fauna of the South-west of Ireland—Foraminifera. Proc. Roy. Irish Acad., ser. 2, vol. iv (1887) (Science), pp. 607–614.

W. 1891, SWI. J. Wright.—Report on the Foraminifera obtained off the South-west of Ireland during the Cruise of the "Flying Falcon," 1888. Proc. Roy. Irish Acad. ser. 3, vol. i, no. 4, pp. 460–502, pl. xx.

W. 1910–11, BCNI. J. Wright.—Boulder-Clays from the North of Ireland, with Lists of Foraminifera. Proc. Belfast Nat. Field Club, ser. 2, vol. iii, Appendix no. 1, p. 8, pl. i.

W. 1910–11, ECM. J. Wright.—Foraminifera from the Estuarine Clays of Magheramorne, Co. Antrim, and Limavady Station (Junction), Co. Derry. Rep. Belfast Nat. Field Club, ser. 2, vol. iii, no. 6, Appendix no. 6, pp. 11–20, pl. ii.

Z. 1876, HP. K. A. Zittel.—Handbuch der Paleontologie. Munich and Leipzig, 1876–1880, vol. i, Protozoa, pp. 55–126.

APPENDIX F.

ON THE COLOURATION OF *POLYTREMA MINIACEUM* (PALLAS).

It would have been a source of satisfaction to us had we been able to pronounce definitely upon the chemical constitution of the red colouring matter of *Polytrema*, and we hoped that, with the comparatively ample material afforded by our collection at Ajaccio, we might have arrived at a definite conclusion.

Brady, in 1884 (F.C., p. 720) observed that "a few preliminary experiments suggest that it is an organic substance, and probably identical with that found by Merejkowsky in a large number of marine organisms, and named by him Zoonerythrine." Merkel, however, in his elaborate thesis (*ut supra*, p. 298) states the results of certain researches which he had undertaken, which go to disprove this suggestion. That it is an organic substance there can be no question, for it entirely disappears under heat—like the colouring matter of red coral. Merkel, after setting forth the processes which he employed towards the solution of the question, says:—"I can hardly agree that the red pigment is Zoonerythrin, as to which Merejkowsky and Krukenberg say that it dissolves easily in alcohol and ether. Also, on treatment with a few drops of H_2SO_4, the characteristic blue colour for Zoonerythrin was not observed."

Dr. R. A. Peters has, at our request, carried out a series of careful experiments with a view to determining the nature of the colouring matter at the Biochemical Laboratory at Cambridge. We need not go at length, in this place, into the processes employed, but we append a condensed note kindly furnished to us on the subject.

PIGMENT OF *POLYTREMA MINIACEUM* (PALLAS).

By R. A. Peters, M.D.

Extraction.—The powdered organism is placed upon a small filter paper, in a filter funnel, and extracted with a small amount of dilute acetic acid. The dilute acid is collected in a test tube, and poured back upon the powdered organism until the calcareous matter has dissolved. More acid is added if necessary. A little of the pigment goes into solution by treatment with dilute acetic acid, but the main bulk remains upon the filter paper. Treatment with hot alcohol at this stage may remove some yellow pigment. (If excess alcohol is added, the residue will set to a jelly.) A small amount of hot alcohol, to which a little NaOH has been added, is poured upon the filter paper. This dissolves the bulk of the pigment forming a yellowish red solution. Further treatment with dilute acid as described by Newbigin (J. Phys. xxi, 236, 1897), and then with alcohol led to the solution of some more pigment, but no definite red compound dissolved as described in the case of crustaceorubin. Treatment with strong acid must be avoided, as it breaks down the pigment to a yellow product.

Characters.—An alcoholic solution, when treated with strong H_2SO_4, shows a blue colouration at the junction of the two fluids, identical with the reaction for the lobster pigment and carotin. This indicates a lipochrome. Spectroscopically, in solutions judged to be of equal concentration, the same bands appeared in the unknown pigment and in a solution of the lobster pigment. The main band appeared to extend to 525λ in the concentration used. Attempts to fractionate between alcohol and petrol ether gave no certain result. When fractionated between an aqueous alcoholic solution and petrol ether, the pigment often deposited as a brick-red precipitate between the solvents, which became soluble again upon treatment with alkali.

Solutions in carbon disulphide and chloroform were red, in ether yellow. In alcohol, they were more reddish than a carotin solution of the same concentration, as judged by the tint. Solutions faded rather rapidly.

Discussion.—In general appearance the pigment resembles the crustaceorubin of Newbigin, though its solubility in alkali indicates a difference. There seems little doubt that we have to do with a lipochrome pigment. Owing to the rarity of the organism, the investigation of the pigment upon the scale employed by Willstätter and Stoll (Chlorophyl, 1913) has been clearly out of the question.

Conclusions.—The pigment is a lipochrome forming yellowish red solutions in alcohol, and red in chloroform and carbon-disulphide. Spectroscopically it resembles the red pigment of the lobster, but differs from this in certain other respects.

INDEX.

Species found in the three separated gatherings, but not in the main material, or noted in the main Report are indicated as follows :—

T. d. F. = from Station 308 (official list). Off Tierra del Fuego. Appendix A.
R. d. J. = from Station 42 (official list). Off Rio de Janeiro. Appendix C.
K. I. = from Kerguelen Island. " Challenger " Station, 149 E. Appendix B.
D. = from " Discovery " material.

abbreviata, Textularia, 120.
abyssorum, Rhabdammina, 91.
,, Rhabdopleura, 91.
acervalis, Planorbulina, 207.
Acervulina inhaerens, 221.
aculeata, Bulimina, 128.
,, Uvigerina, 184.
acuta, Fissurina, 154.
,, Jaculella, 85.
,, Lagena, 154.
acutauricularis, Cristellaria, 178.
,, Nautilus, 178.
acuticosta, Lagena, 146.
adolphina, Dentalina, 172.
,, Nodosaria, 172.
adunca, Reophax, 96.
advena, Reophax, 94.
aenariensis, Bolivina, 134.
,, Brizalina, 134.
aequilateralis, Globigerina, 192.
affinis, Bulimina, 128.
,, Sagraina, 117.
affixa, Spiroloculina, 63.
agglutinans, Haplophragmium, 97.
,, Miliolina, 69.
,, Quinqueloculina, 69.
,, Spirolina, 97.
,, Textularia, 119.
,, var. porrecta, Textularia, 119.
aggregata, Placopsilina, 75.
akneriana, Rosalina, 210.
,, Truncatulina, 210.
alata (var.), Bolivina, 134.
,, Valvulina, 134.
albicans (var.), Thurammina, 108.
albida, Storthosphaera, 77.
algaeformis, Rhizammina, 92.
alto-camerata (var.), Truncatulina, 209.
alveolata, Lagena, 167.
alveolata, var. substriata, Lagena, 167.
alveoliniformis, Miliolina, 65.
americanus, Ammobaculites, 98.
Ammobaculites americanus, 98.
,, foliaceum, 99.
,, tenuimargo, 98.
Ammochilostoma pauciloculata, 114.
Ammodiscus charoides (J. & P.), 110.
,, filum, 88.
,, gordialis (J. & P.), 88, 110.
,, incertus (d'Orb.), 74, 109, 195.
,, megaspira, 110.
,, mestayeri (Cush.), 109.
,, shoneanus (Siddall), 110.
,, tenuis, Br., 74, 109.
Ammolagena clavata, 115.
ammonoides, Nautilus, 230.
,, Operculina, 230.
Ammosphaeroidina sphaeroidiniforme, 102.
Amphicoryne parasitica, 179.
Amphorina gracilis, 144.
,, lyellii, 146.
ampulla-distoma, Lagena, 145.
,, (var.), Lagena, 145.
ampullacea, Reophax, 93.
,, (var.), Uvigerina, 184.
anceps, Globotextularia, 118.
,, Haplophragmium, 102.
anglica (var.), Saccammina, 85.
angulosa, Uvigerina, 183.
angusta, Polymorphina, 181.
annectens, Lagena, 155.
,, Spiroplecta, 121.
,, Textularia, 121.
annularis, Frondicularia, 175.

annularis, Orbitolina, 198.
,, (var.), Patellina, 198.
Anomalina ariminensis, d'Orb., 212.
,, coronata, P. & J., 212.
,, foveolata, Br. [R. d. J.], 233.
,, polymorpha, Costa, 212.
,, sinuosa, Sideb., 213.
,, wuellerstorfi, 210.
antarctica (var.), Dendronina, 80.
apiculata (var.), Bulimina, 129.
,, Lagena, 143.
,, Oolina, 143.
arborescens, Dendronina, 78.
,, Psammatodendron, 87.
,, Hyperammina, 87.
,, var. antarctica, Dendronina, 80.
arenacea, Spirillina, 109.
,, (var.), Bifarina, 132, 133.
,, ,, Bolivina, 135, 233.
,, ,, Miliolina, 66, 232.
,, ,, Nonionina, 228.
,, ,, Rotalia, 220.
,, ,, Truncatulina, 208.
arenaria, Astrorhiza, 75.
,, Spiroloculina, 64.
arenosa, Bolivina, 134.
argenteus, Bathysiphon, 82.
ariminensis, Anomalina, 212.
Aristerospira crassa, 190.
,, pachyderma, 190.
arthrocena, Orthoceras, 172.
articulata, Cristellaria, 179.
,, Robulina, 179.
Articulina conico-articulata, 72.
,, funalis, Br., 72.
,, ,, var. inornata, Br., 72.
Aschemonella catenata, Norm. [T. d. F.]., 230.
aspera, Lagena, 144.
asperula, Uvigerina, 184.
,, var. ampullacea, Uvigerina, 184.
asterizans, Nautilus, 226.
,, Nonionina, 226.
Astrorhiza arenaria, Norm., 75.
,, catenata, 230.
,, limicola, Sandahl, 75.
Ataxophragmium humile, 130.
auberiana, Miliolina, 68.
,, Quinqueloculina, 68.
,, Uvigerina, 184.
,, var. arenacea, 232.
,, ,, glabra, Uvigerina, 185.
auricula, Nautilus, 214.
,, Pulvinulina, 214.
auriculata, Lagena, 166.
,, var. clypeata, Lagena, 164.
auriculata, var. costata, Lagena, 235.
,, ,, quadri-auriculata, Lagena, 167.

baccata, Discorbina, 200.
,, (var.), Lagena, 162.
bacillaris, Reophax, 94, 170.
baconica, Discorbina, 203.
,, (var.), Discorbina, 203.
balaniformis, var. proteiformis, Carpenteria, 213.
barrettii, Textularia, 232.
Bathysiphon argenteus, H.-A. & E., 82.
,, filiformis, M. Sars., 82.
,, rufum, de Folin, 82.
beccarii, Nautilus, 219.
,, Rotalia, 219.
bertheloti, Discorbina, 202.
,, Rosalina, 202.
,, var. baconica, Discorbina, 203.
berthelotiana, Pulvinulina, 218.
,, Rotalina, 218.
beyrichi, Bolivina, 134.
,, var. alata, Bolivina, 134.
bicarinata, Fissurina, 160.
,, Lagena, 160.
,, var. spinigera, Lagena, 161.
,, var. villosa, Lagena, 161.
,, Discorbina, 206.
Bifarina porrecta, Br., 132.
,, ,, var. arenacea, nov., 132.
biformis, Spiroplecta, 122.
,, (var.) Textularia, 122.
bifrons, Sagrina, 186.
,, Siphogenerina, 186.
bilobata, Orbulina, 193.
biloculi, Lingulina, 174.
,, (var.) Lingulina, 174.
Biloculina, bradyi, 62.
,, bulloides, d'Orb., 61.
,, comata, Br., 62.
,, depressa, d'Orb., 62.
,, ,, var. murrhyna, Schw., 62.
,, ,, ,, serrata, Bailey, 63.
,, elongata, d'Orb., 62.
,, irregularis, d'Orb., 61.
,, laevis, Def. [R. d. J.], 232.
,, lucernula, 61.
,, ringens (Lam.), 61.
,, sphaera, d'Orb., 61.
Bolivina aenariensis (Costa), 134.
,, arenosa, 134.
,, beyrichi, Rss., 134.
,, ,, var. alata (Seg.), 134.
,, decussata, Br., 134.
,, difformis (Will.), 135.
,, dilatata, Rss., 134.

Bolivina inflata, H.-A, & E., 135.
,, ,, var. arenacea, nov., 135.
,, karreriana, Br., 136.
,, limbata, Br., 137.
,, lobata, Br., 134.
,, nobilis, Hant. [R. d. J.], 233.
,, obsoleta (Ehbg.), 136.
,, plicata, d'Orb., 135.
,, porrecta, 132.
,, punctata, d'Orb., 132.
,, ,, var. arenacea, nov., 133.
,, pygmaea, 135.
,, reticulata, Hant., 135.
,, robusta, Br., 136.
,, textilarioides, Rss., 133.
,, ,, var. arenacea, nov. [D.], 133.
,, ,, var. spinescens, Cush., 133.
,, tortuosa, var. arenacea, nov. 136.
,, variabilis (Will.), 135.
,, ,, var. arenacea, nov., [D.], 234.
bosciana, Miliolina, 66.
,, Quinqueloculina, 66.
botelliformis, Lagena, 143.
boueana, Nonionina, 101, 227.
,, var. janiformis, Nonionina, 227.
bouei, Fissurina, 148.
bowmanni, Psammosphaera, 83.
bradyi, Biloculina, 62.
,, Cassidulina, 139.
,, Nubecularia, 60.
,, var. elongata, Cassidulina, 139.
Brizalina aenariensis, 134.
brongniartii, Miliolina, 70.
,, Pulvinulina, 215.
,, Rotalia, 215.
,, Triloculina, 70.
bruckenthali, Vaginulina, 176.
brunnensis, Uvigerina, 184.
bucculenta, Miliolina, 65.
buchiana, Bulimina, 129.
Bulimina aculeata, d'Orb., 128.
,, affinis, d'Orb., 128.
,, buchiana, d'Orb., 129.
,, chapmani, sp. nov., 130.
,, convoluta, Will., 130.
,, contraria, 131.
,, declivis, Rss., 130.
,, echinata, d'Orb., 128.
,, elegans, d'Orb., 127.
,, ,, var. exilis, Br., 127.
,, elegantissima, d'Orb., 129.
,, ,, var. apiculata, 129.
,, ,, ,, fusiformis, 129.
Bulimina elegantissima, var. seminuda, Terq., 129.
,, fusiformis, Will., 127.
,, inflata, Seg., 128.
,, marginata, d'Orb., 128.
,, ovata, d'Orb., 128.
,, polystropha, 124.
,, pupoides, d'Orb., 127.
,, pygmaea, 125.
,, pyrula, d'Orb., 127.
,, rostrata, Br., 129.
,, seminuda, 129, 130.
,, squammigera, d'Orb., 131.
,, subteres, Br., 130.
,, williamsoniana, Br., 130.
bulla, Placopsilina, 104.
,, Tholosina, 104.
bulloides, Biloculina, 61.
,, Cymbalopora, 199.
,, Globigerina, 187.
,, Rosalina, 199.
,, Sphaeroidina, 194.
Burseolina calabra, 139.

calabra, Burseolina, 139.
,, Cassidulina, 139.
calcar, Cristellaria, 180.
,, Nautilus, 180.
calcarata, Miliolina, 68.
,, Discorbina, 204.
calcareum, Haplophragmium, 98.
calomorpha, Nodosaria, 168.
canaliculata (var.), Thurammina, 85.
canariense, Haplophragmium, 100.
,, var. variabilis, Haplophragmium, 100.
canariensis, Nonionina, 100.
,, Pulvinulina, 215.
,, Rotalina, 215.
,, Uvigerina, 183.
cancellata, Cyclammina, 116.
candeiana, Miliolina, 68.
,, Quinqueloculina, 68.
,, Textularia, 119.
carinata, Fissurina, 156.
,, Lingulina, 173.
,, var. biloculi, Lingulina, 174.
,, (var.), Spirillina, 195.
cariosa (var.), Thurammina, 84.
carlofortensis, Lingulina, 174.
Carpenteria proteiformis, Goës, 213.
Cassidulina bradyi, Norm., 139.
,, ,, var. elongata, Sideb., 139.
,, calabra (Seg.), 139.
,, crassa, d'Orb., 138.
,, decorata, 138.

Cassidulina devonica, 138.
,, laevigata, d'Orb., 137.
,, ,, var. tumida, nov., 137.
,, nitidula (Chaster),140.
,, oblonga (Rss.), 138.
,, parkeriana, Br., 139.
,, sub-globosa, Br., 138.
,, ,, var. tuberculata, nov., 138.
cassis, Cristellaria, 233.
,, Nautilus, 233.
,, Haplophragmium, 177.
castanea (var.), Thurammina, 107.
castrensis, Lagena, 164.
catenata, Aschemonella, 230.
,, Astrorhiza, 230.
,, Textularia, 117.
catenulata, Lagena, 152.
,, (var.), Lagena, 152.
,, Nodosaria, 172.
celata, Planispirina, 71.
,, Sigmoilina, 71.
cenomana, Placopsilina, 103.
Ceriopora globulus, 221.
chapmani, Bulimina, 130.
,, Marsipella, 90.
charoides, Ammodiscus, 110.
,, Cornuspira, 110.
chasteri, Discorbina, 202.
Chilostomella ovoidea, Rss., 142.
chrysostoma, Miliolina, 64.
Cibicides refulgens, 207.
circularis, Miliolina, 64.
,, Triloculina, 64.
,, var. sublineata, Miliolina, 64.
clathrata, Lagena, 165.
,, Rotalia, 220.
clavata, Ammolagena, 115.
,, Lagena, 231.
,, Oolina, 231.
,, Webbina, 115.
clavatula (var.), Hyperammina, 88.
Clavulina communis, d'Orb., 126.
,, cylindrica, Hant., 126.
,, obscura, Chaster, 126.
,, parisiensis, d'Orb., 126.
clavulus, Lagena, 145.
cliarensis, Planispirina, 73.
clypeata (var.), Lagena, 164.
clypeato-marginata (var.), Lagena, 165.
,, var. crassa, Lagena, 165.
colligera, Truncatulina, 209.
columellaris, Sagrina, 185.
comata, Biloculina, 62.
,, (var.), Lagena, 160.
comata, Nodosaria, 171.
comatus, Nautilus, 171.
communis, Clavulina, 126.
,, Nodosaria 169.
,, Polymorphina, 182.
compressa, Polymorphina, 182.
concamerata (var.), Pulvinulina, 213.
,, Serpula, 213.
concava, Textularia, 117.
,, var. heterostoma, Textularia, 117.
concavum, Plecanium, 117.
concentrica (var.), Lagena, 162.
,, Pulvinulina, 214.
confusa, Sorosphaera, 84.
conglobata, Globigerina, 192.
conica, Textularia, 121.
,, Valvulina, 125.
,, var. horrida, Textularia, 121.
conico-articulata, Articulina, 72.
consobrina, Nodosaria, 170.
,, var. emaciata, Nodosaria, 170.
contorta, Miliolina, 69.
,, Quinqueloculina, 69.
convergens, Cristellaria, 178.
convoluta, Bulimina, 130.
,, (var.), Bulimina, 130.
coprolithiforme, Haplophragmium, 97.
cora, Discorbina, 199.
,, Rosalina, 199.
Cornuspira charoides, 110.
,, diffusa, H.-A. & E., 74.
,, foliacea (Phil.), 73, 109, 195.
,, involvens, Rss., 74, 86, 109, 195.
,, oligogyra, 196.
,, polygyra, 195.
,, selseyensis, H.-A. & E., 74.
,, striolata, Br., 75.
cornuta (var.), Miliolina, 68.
,, Rhabdammina, 84.
coronata, Anomalina, 212.
,, (var.), Lagena, 163.
,, Trochammina, 112, 113.
corrugata, Patellina, 198.
,, (var.), Textularia, 121.
,, ,, annularis, Patellina, 198.
costata, Cristellaria, 180.
,, Entosolenia, 147.
,, Lagena, 147.
,, (var.), Lagena, 235.
,, Marginulina, 176.
costatus, Nautilus, 176, 180.
crassa, Aristerospira, 190.
,, Cassidulina, 138.
,, (var.), Lagena, 165.
,, Pulvinulina, 216.

crassa, Rotalina, 216.
crassimargo, Haplophragmium, 101.
craticulata, Rotalia, 220.
crenata, Lagena, 149.
crepidula, Cristellaria, 177.
,, Nautilus, 177.
cretacea, Globigerina, 188.
,, var. eggeri, Globigerina, 188.,
crispa, Polystomella, 229.
crispus, Nautilus, 229.
cristata, Miliolina, 68.
Cristellaria acutauricularis (F. & M.), 178.
,, articulata (Rss.), 179.
,, calcar (Linn.), 180.
,, cassis (F. & M.) [R. d. J.], 233.
,, convergens (Born.), 178.
,, costata (F. & M.), 180.
,, crepidula (F. & M.), 177.
,, cultrata (Montf.), 180.
,, cymboides, d'Orb., 178.
,, dorsocostata, 180.
,, gibba, d'Orb., 179.
,, italica (Def.), 178.
,, latifrons, Br., 178.
,, orbicularis (d'Orb.), 179.
,, paucicostata, 180.
,, pauciseptа, Rss., 178.
,, rotulata (Lam.), 179.
,, schlocnbachi, Rss., 177.
,, tenuis (Born.), 177.
,, tricarinella, Rss., 177.
,, variabilis, Rss., 177.
,, vortex (F. & M.), 179.
Crithionina granum, Goës, 78, 105.
,, lens, Goës, 107.
,, mamilla, Goës, 105, 233.
,, pisum, Goës, 106.
,, ,, var. hispida, Flint, 106, 234.
,, rotundata, 106.
,, rugosa, Goës, 77, 106.
culter, Planorbulina, 211.
,, Truncatulina, 211.
cultrata, Cristellaria, 180.
cultratus, Robulus, 180.
Cuneolina pavonia, d'Orb. [R. d. J.], 232.
cuvieriana, Miliolina, 69.
,, Quinqueloculina, 69.
Cyclammina cancellata, Br., 116, 233.
,, orbicularis, Br., 116.
,, pusilla, Br., 115.
cylindrica, Clavulina, 126.
,, Marsipella, 90.
,, Pelosina, 77.
,, Reophax, 97.
Cymbalopora bulloides (d'Orb.), 199.
Cymbalopora poeyi (d'Orb.), 198.
cymboides, Cristellaria, 178.

danica, Lagena, 166.
,, var. pendulum, Lagena, 166.
decipiens, Polystomella, 229.
declivis, Bulimina, 130.
decorata, Cassidulina, 138.
,, Spirillina, 197.
,, (var.), Nubecularia, 60.
,, ,, unilatera, Spirillina, 195.
decussata, Bolivina, 134.
dehiscens, Sphaeroidina, 194.
Dendronina arborescens, gen. et sp. nov., 78.
,, ,, var. antarctica, nov., 80.
,, limosa, sp. nov., 81.
,, ,, var. humilis, nov., 81
Dendrophrya erecta, 80.
Dentalina adolphina, 172.
,, emaciata, 170.
,, mucronata, 170.
,, pauperata, 170.
,, roemeri, 170.
,, soluta, 169.
dentaliniformis, Lingulina, 173.
,, Reophax, 94.
denticulata, Quinqueloculina, 68.
,, (var.), Spirillina, 197.
denticulo-carinata, Frondicularia, 171
depressa, Biloculina, 62.
,, Storthosphaera, 77, 231.
,, var. murrhyna, Biloculina, 62
,, ,, serrata, Biloculina, 62
depressula, Nonionina, 226.
depressulus, Nautilus, 226.
desmophora, Lagena, 149.
,, (var.), Lagena, 149.
devonica, Cassidulina, 138.
diaphana, Iridia, 75.
difflugiformis, Reophax, 92.
difformis, Bolivina, 135.
,, (var.), Textularia, 135.
diffusa, Cornuspira, 74.
dilatata, Bolivina, 134.
dimorpha, Sagrina, 186.
,, Uvigerina, 186.
Dimorphina raphanus, 186.
,, striata, 186.
Dioxeia richardi, 90.
Discorbina baccata, H.-A. & E., 200.
,, berthcloti (d'Orb.), 202.
,, ,, var. baconica, Hant. 203.
,, biconcava, P. & J., 206.
,, calcarata, sp. nov., 204.
,, chasteri, H.-A. & E., 202.

Discorbina cora (d'Orb.), 199.
,, disparilis, sp. nov., 205.
,, globularis (d'Orb.), 115, 201.
,, harmeri, sp. nov., 204.
,, imperatoria, 204.
,, involuta, 205.
,, irregularis, Rhumb., 201.
,, isabelleana (d'Orb.), 199.
,, lingulata, Burr. & Holl. , 206.
,, ,, var. unguiculata, Sideb., 207.
,, mediterranensis (d'Orb.), 201.
,, millettii, Wright, 199.
,, minutissima, 202.
,, nitida (Will.), 199.
,, obtusa (d'Orb.), 202.
,, opercularis (d'Orb.), 203.
,, orbicularis (Terq.), 200.
,, parisiensis (d'Orb.), 203.
,, patelliformis, Br., 204.
,, peruviana (d'Orb.), 200.
,, pileolus (d'Orb.), 204.
,, plano-convexa, 209.
,, polyrraphes (Rss.), 201.
,, praegeri, H.-A. & E., 199.
,, pulvinoides, Cush., 206.
,, pustulata, H.-A. & E., 203.
,, rarescens, Br., 203.
,, rosacea (d'Orb.), 200.
,, rugosa (d'Orb.), 112, 202.
,, saulcii (d'Orb.), 202.
,, tabernacularis, Br., 205.
,, tuberculata, Balk. & Wright [R. d. J.], 233.
,, turbo (d'Orb.), 200.
,, valvulata (d'Orb.), 202.
,, ventricosa, 206.
,, vilardeboana (d'Orb.), 111, 200.
,, wilsoni, sp. nov., 206.
Discorbis inconspicua, 116.
discreta, Rhabdammina, 91.
disparilis, Discorbina, 205.
distans, Reophax, 59, 96.
distoma, Lagena, 235.
divaricans, Sagenina, 60.
dorsocostata, Cristellaria, 180.
dubia, Globigerina, 188.
dutemplei, Rotalina, 211.
,, Truncatulina, 211.
dutertrei, Globigerina, 189.

carlandi, Seabrookia, 141.
echinata, Bulimina, 128.
,, Triloculina, 68.
edwardsi, Planispirina, 71.
,, Sigmoilina, 71.
edwardsi, Trioxeia, 90.
eggeri (var.), Globigerina, 188.
Ehrenbergina hystrix, Br., 140.
,, ,, var. glabra, nov., 140.
,, serrata, Rss., 140.
elegans, Bulimina, 127.
,, Pulvinulina, 218.
,, Rotalia, 218.
,, var. exilis, Bulimina, 127.
elegantissima, Bulimina, 129.
,, Polymorphina, 182.
,, (var.), Thurammina, 85.
,, var. seminuda, Bulimina, 129.
elevata (var.), Globigerina, 191.
elongata, Biloculina, 62.
,, Hyperammina, 87.
,, Lagena, 144.
,, Marsipella, 90.
,, Miliola, 144.
,, (var.), Cassidulina, 139.
,, var. laevigata, Hyperammina, 88.
,, ,, tenuissima, Hyperammina, 88.
emaciata, Dentalina, 170.
,, (var.), Nodosaria, 170.
emaciatum, Haplophragmium, 98.
enderbiensis, Lagena, 161.
Entosolenia costata, 147.
,, lineata, 146.
,, marginata, var. lucida, 154.
,, ,, var. ornata, 159.
,, ,, var. quadrata, 153.
,, squamosa, var. catenulata, 152.
,, ,, var. hexagona, 152.
,, williamsoni, 146.
erecta, Dendrophrya, 80.
erinacea, Pulvinulina, 206.
euneta, Reophax, 96.
excavata, Spiroloculina, 63.
excentrica (var.), Lagena, 148.
excisa, Miliolina, 68.
exigua, Planispirina, 73.
,, Pulvinulina, 217.
exilis var., Bulimina, 127.
exsculpta, Lagena, 149.

faba, Lagena, 155.
,, (var.), Lagena, 155.
,, Nautilus, 229.
,, Polystomella, 229.
farcimen, Nodosaria, 168.
,, Orthoceras, 168.
fasciata, Lagena, 155.
,, Oolina, 155.
,, var. faba, Lagena, 155.
favosa (var.), Lagena, 160.

favosa (var.), Thurammina, 117.
favus, Pulvinulina, 219.
ferruginea, Gaudryina, 123.
ferussacii, Miliolina, 70.
,, Quinqueloculina, 70.
filiformis, Bathysiphon, 82.
,, Gaudryina, 122.
,, Nodosaria, 169.
filum, Ammodiscus, 88.
,, Serpula, 88.
fimbriata, Lagena, 166.
,, var. occlusa, Lagena, 166.
fissa (var.), Lagena, 157.
Fischerina helix, H.-A. & E., 73.
Fissurina acuta, 154.
,, bicarinata, 160.
,, bouei, 148.
,, carinata, 156.
,, laevigata, 153.
,, multicosta, 148.
,, orbignyana, 161.
,, radiata, 159.
,, rizzae, 160.
,, schlichti, 156.
,, staphyllearia, 154.
fistulosa (var.), Spiroplecta, 119.
,, ,, Textularia, 119.
foliacea, Cornuspira, 73.
foliaceum, Ammobaculites, 99.
,, Haplophragmium, 99.
foliaceus, Orbis, 73.
fontinense, Haplophragmium, 98.
forficula, Lagena, 156.
formosa, Lagena, 159.
,, var. comata, Lagena, 160.
,, ,, favosa, Lagena, 160.
foveolata, Anomalina, 233.
,, Lagena, 150.
,, var. paradoxa, Lagena, 150.
,, ,, spinipes, Lagena, 150.
frondescens, Sagenina, 60.
Frondicularia annularis, d'Orb., 175.
,, denticulo-carinata, 174.
,, inaequalis, Costa, 175
,, pygmaea, Sidcb., 174.
,, reussi, 175.
,, scottii, sp. nov., 175.
,, spathulata, Br., 174.
funalis, Articulina, 72.
,, var. inornata, Articulina, 72.
fungiformis, Textularia, 120.
fusca, Miliolina, 69.
,, Psammosphaera, 83.
,, Rotalina, 125.
,, Quinqueloculina, 69.
fusca, Valvulina, 125.
,, var. testacea, Psammosphaera, 83.
fusiformis, Bulimina, 127.
(var.), Bulimina, 127, 129.
,, Proteonina, 93.
,, Reophax, 93.

galeata, Trochammina, 114.
Gaudryina ferruginea, sp. nov., 123.
,, filiformis, Berthelin, 122.
,, jonesiana, 123.
,, pariana, 123.
,, pupoides, d'Orb., 122, 123.
,, rugosa, d'Orb., 122.
,, scabra, Br., 123.
,, siphonella, Rss., 123.
,, subrotunda, Schw., 122.
,, wrightiana, 123.
gaussii, Vanhoefenella, 76.
gibba, Cristellaria, 179.
,, Polymorphina, 181.
glabra (var.), Ehrenbergina, 140.
,, Marginulina, 176.
,, (var.) Uvigerina, 185.
Glandulina rotundata, 167.
Globigerina aequilateralis, Br., 188, 192.
,, bulloides, d'Orb., 102, 187, 189, 190.
,, conglobata, Br., 192.
,, cretacea, d'Orb., 188.
,, ,, var. eggeri, nov., 188.
,, dubia, Egger, 102, 188.
,, dutertrei, d'Orb., 102, 189.
,, helicina, d'Orb., 192.
,, inflata, d'Orb., 188.
,, omphalotetras, 190.
,, pachyderma (Ehbg.), 190.
,, rubra, d'Orb., 191.
,, ,, var. elevata, d'Orb., 191.
,, sacculifera, Br., 192.
,, triloba, Rss., 187.
,, trochoides, 191.
globigeriniforme, Haplophragmium, 102.
globigeriniformis (var.), Lituola, 102.
,, Trochammina, 102.
globosa, Lagena, 142.
,, Serpula, 142.
,, var. lineato-punctata, Lagena, 142.
Globotextularia anceps, 118.
globularis, Discorbina, 201.
,, Rosalina, 201.
globulifera, Hormosina, 108.
,, Ramulina, 186.
globulosa, Trochammina, 189.
globulus, Ceriopora, 221.

globulus, Gypsina, 221.
glomerata, Lituola, 100.
glomeratum, Haplophragmium, 100.
gordialis, Ammodiscus, 110.
gracilis, Amphorina, 144.
,, Lagena, 147.
,, Miliolina, 67.
,, Nodosaria, 169.
,, Quinqueloculina, 67.
gracillima, Lagena, 144.
gramen, Textularia, 121.
grandis, Lingulina, 173.
,, Reophax, 157.
granum, Crithionina, 78, 105.
grimaldii, Ramulina, 187.
Gromia oviformis, Duj., 59,
guttifera, Reophax, 234.
Guttulina rotundata, 182.
Gypsina globulus (Rss.), 221.
,, inhaerens (Schultze), 113, 221.
,, vesicularis (P. & J.), 221.
Gyroidina orbicularis, 219.
,, soldanii, 219.

haeusleri (var.), Thurammina, 107.
haidingerii, Rotalina, 210.
,, Truncatulina, 210.
haliotidea, Pulvinulina, 215.
Haplophragmium agglutinans (d'Orb.), 97.
,, anceps, Br., 118, 102.
,, calcareum, Br., 98.
,, canariense (d'Orb.),100, 226, 227.
,, ,, var. variabilis, H.-A. & E., 100, 209.
,, cassis, 177.
,, coprolithiforme, 97.
,, crassimargo, Norm., 101.
,, emaciatum, Br., 98.
,, foliaceum, Br., 99.
,, fontinense, Terq., 98.
,, globigeriniforme, P. & J., 102, 187, 188, 189, 190.
,, glomeratum, Br., 100, 220.
,, lagenarium, 143.
,, latidorsatum (Born.). 99.
,, nanum, Br., 101, 228.
,, nonioninoides, 226.
,, pseudospirale, Will., 97.
,, rotulatum, Br., 99.
,, scitulum, Br., 99, 227.
,, scruposum, 92, 144.
,, sphaeriloculum, Cush., 100, 101.
,, sphaeroidiniforme, Br., 102, 194.
,, tenuimargo, Br., 98.
,, trullissata, 113.
Haplophragmoides rotulatum, 99.
,, sphaeriloculum, 101.
harmeri, Discorbina, 204.
harrisii, Nouria, 103.
Hastigerina pelagica, Br., 193.
hauerii, Rotalina, 214.
,, Pulvinulina, 214.
helicina, Globigerina, 192.
helix, Fischerina, 73.
hemispherica, Webbina, 75.
heterostoma (var.), Textularia, 102, 117.
hexagona (var.), Entosolenia, 152.
,, Lagena, 152.
,, (var.), Lagena, 165.
Hippocrepina indivisa, Parker [D.], 234.
hispida (var.), Crithionina, 106.
,, Lagena, 145.
,, Nodosaria, 171.
hispidipholus, Lagena, 153.
Hormosina globulifera, Br., 108.
Hormosina ovicula, 168.
horrida (var.), Textularia, 121.
humile, Ataxophragmium, 130.
humilis (var.), Dendronina, 81.
Hyperammina arborescens (Norm.), 87.
,, elongata, Br., 87.
,, ,, var. clavatula, 88.
,, ,, var. laevigata, Wright, 88.
,, ,, var. tenuissima, nov., 88.
,, mestayeri, 87.
,, novae-zealandiae. nom. nov., 89.
,, ramosa, Br., 86.
,, sub-nodosa, 89.
,, vagans, Br., 86.
Hyperamminella venusta, 88.
hystrix, Ehrenbergina, 140.
,, var. glabra, Ehrenbergina, 140.

imperatoria, Discorbina, 204.
inaequalis, Frondicularia, 175.
,, Spirillina, 196.
inaequilateralis (var.), Lagena, 157.
,, Spiroloculina, 63.
incerta, Operculina, 109.
incertus, Ammodiscus, 74, 109.
inconspicua, Discorbis, 116.
,, Textularia, 116.
indivisa, Hippocrepina, 234.
inflata, Bolivina, 135.
,, Bulimina, 128.
,, Globigerina, 188.
,, Nubecularia, 60.
,, Polymorphina, 182.

inflata, Textularioides, 119,
,, Trochammina, 112.
,, var. arenacea, Bolivina, 135.
inflatus, Nautilus, 112.
inflexa, Nodosaria, 59, 96.
inhaerens, Acervulina, 221.
,, Gypsina, 221.
inornata (var.), Articulina, 72.
,, Tubinella, 72.
insignis, Miliolina, 65.
intermedia, Placopsilina, 75.
interrupta (var.), Lagena, 146.
,, Uvigerina, 185.
involuta, Discorbina, 205.
Iridia diaphana, H.-A. & E., 75, 233.
irregularis, Biloculina, 61.
,, Discorbina, 201.
,, Webbina, 115.
isabelleana, Discorbina, 199.
,, Rosalina, 199.
italica, Cristellaria, 178.
,, Saracenaria, 178.

Jaculella acuta, Br., 85.
,, obtusa, Br., 86.
janiformis (var.), Nonionina, 101, 227.
jonesiana, Gaudryina, 123.

karreriana, Bolivina, 136.
karsteni, Pulvinulina, 218.
,, Rotalia, 218.
kingsleyi, Placopsilina, 103.

labiosa, Miliolina, 65.
,, Triloculina, 65.
lactea, Polymorphina, 180.
,, Serpula, 180.
,, var. oblonga, Polymorphina, 180.
lacunata, Lagena, 164.
laeve, Vermiculum, 143.
laevigata, Cassidulina, 137.
,, Fissurina, 153.
,, (var.), Hyperammina, 88.
,, Lagena, 153.
,, Nodosaria, 167.
,, Webbina, 115.
,, var. tumida, Cassidulina, 137.
laevis, Biloculina, 232.
,, Lagena, 143.
,, Pyrgo, 232.
Lagena acuta (Rss.), 154.
,, acuticosta, Rss., 146.
,, alveolata, Br., 167.
,, var. substriata, Br., 167.
Lagena ampulla-distoma, Rymer Jones, 145.
,, annectens, Burr and Holl., 155.
,, apiculata (Rss.), 93, 143.
,, aspera, Rss., 144.
,, auriculata, Br., 166.
,, ,, var. costata, Sideb. [D.], 235.
,, ,, ,, quadri - auriculata, nov., 167.
,, bicarinata (Terq.), 159, 160.
,, ,, var. spinigera, nov., 161.
,, ,, ,, villosa, nov., 161.
,, botelliformis, Br., 143.
,, castrensis, Schw., 164.
,, catenulata, Rss., 152.
,, clathrata, Br., 165.
,, clavata (d'Orb.) [K. I.], [D.], 231.
,, clavulus, sp. nov., 145.
,, clypeato-marginata, var. crassa, Sideb., 165.
,, costata (Will.), 147.
,, crenata, P. & J., 149.
,, danica, Madsen, 166.
,, ,, var. pendulum, nov., 166.
,, desmophora, Rymer Jones, 149.
,, distoma, P. & J. [D.], 235.
,, elongata (Ehbg.), 144.
,, enderbiensis, Chap., 161.
,, exsculpta, Br., 149.
,, fasciata, Egger, 155.
,, ,, var. faba, Balk. & Mill., 155.
,, fimbriata, Br., 166.
,, ,, var. occlusa, Sideb., 166.
,, forficula, H.-A. & E., 156.
,, formosa, Schw., 159.
,, ,, var. comata, Br., 160.
,, ,, ,, favosa, Br., 160.
,, foveolata, Rss., 150.
,, ,, var. paradoxa, Sideb., 150.
,, ,, ,, spinipes, Sideb., 150.
,, globosa (Mont.), 142.
,, ,, var. lincato-punctata, nov., 142.
,, gracilis, Will., 147.
,, gracillima (Seg.), 144.
,, hexagona (Will.), 152.
,, hispida (Rss.), 145.
,, hispidipholus, 153.
,, lacunata, Burr. & Holl., 164.
,, laevigata (Rss.), 153.
,, laevis (Mont.), 92, 143.
,, lagenoides (Will.), 158.
,, ,, var. nuda, Chap., 159.
,, ,, ,, tenuistriata, Br., 158.
,, lineata (Will.), 146.
,, longispina, Br., 143.
,, lucida (Will.), 154.
,, lyellii (Seg.), 146.

Lagena malcomsonii, Wright, 155.
,, marginata (Walk. & Boys), 156.
,, ,, var. fissa, nov., 157.
,, ,, ,, inaequilateralis, Wright, 157.
,, ,, ,, rari-costata, Sideb., 157.
,, ,, ,, semi-marginata, Rss., 157.
,, marginato-perforata, Seg., 158.
,, melo (d'Orb.), 151, 152.
,, multicosta (Karr.), 148.
,, orbignyana (Seg.), 161.
,, ,, var. alata, Cush. [D.], 235.
,, ,, ,, baccata, nov., 162.
,, ,, ,, concentrica, Sideb., 162.
,, ,, ,, coronata, Sideb., 163.
,, ,, ,, selseyensis, H.-A. & E., 162.
,, ,, ,, unicostata, Sideb., 163.
,, ,, ,, walleriana, Wright, 162.
,, ,, ,, yokoyamae, Mill., 163.
,, ornata (Will.), 159.
,, ovum (Ehbg.), 143.
,, pannosa, Mill. [D.], 235.
,, plumigera, Br., 147.
,, protea, Chaster, 153.
,, pulchella, Br., 165.
,, ,, var. hexagona, H.-A. & E., 165.
,, quadrangularis, Br., 160.
,, quadrata (Will.), 155.
,, quinquelatera, Br., 160.
,, reniformis, Sideb., 155
,, reticulata (Macgillivray), 152.
,, rizzae (Seg.), 160.
,, rudis, 144.
,, scarabaeus, sp. nov., 164.
,, schlichti (Silv.), 156.
,, scottii, sp. nov., 150.
,, seminiformis, Schw., 158.
,, seminuda, Br., 153.
,, semistriata, Will., 147.
,, sphaerula, Silv., 144.
,, spumosa, Mill., 150.
,, squamosa (Mont.) 151.
,, squamoso-sulcata, sp. nov., 151.
,, staphyllearia (Schw.), 154.
,, stelligera Br., 148.
,, ,, var. excentrica, Sideb., 148.
,, ,, ,, nelsoni, nov., 148.
,, striata (d'Orb.), 145.
,, striato-punctata, P. & J., 149.
,, sulcata (W. & J.), 146.
,, tubulifera, var. tenuistriata, 158.
,, unguiculata, Br., 154.
,, unguis, H.-A. & E., 157.
,, ventricosa, Silv., 154.
Lagena vulgaris, var. spinoso-marginata, 159.
,, williamsoni (Alcock), 146.
lagenarium, Haplophragmium, 143.
lageniformis, Reophax, 153.
lagenoides, var. nuda, Lagena, 159.
,, ,, tenuistriata, Lagena, 158.
Lagenula reticulata, 152.
lanceolata, Polymorphina, 181.
latidorsata, Nonionina, 99.
latidorsatum, Haplophragmium, 99.
latifrons, Cristellaria, 178.
legumen, Nautilus, 176.
,, Technitella, 231.
,, Vaginulina, 176.
lens, Crithionina, 107.
lenticularis, Reophax, 157.
Lenticulites rotulata, 179.
limbata, Bolivina, 137.
,, Spirillina, 196.
,, var. denticulata, Spirillina, 197.
limicola, Astrorhiza, 76.
limosa, Dendronina, 81.
,, var. humilis, Dendronina, 81.
lineata, Entosolenia, 146.
,, Lagena, 146.
lineato-punctata (var.), Lagena, 142.
lingulata, Discorbina, 206.
,, var. unguiculata, Discorbina, 207
Lingulina biloculi, Wright, 174.
,, carinata, d'Orb., 173.
,, dentaliniformis, 173.
,, grandis, 173.
Lingulinopsis carlofortensis, 174.
linneiana, Miliolina, 70.
,, Quinqueloculina, 70.
Lituola glomerata, 100.
,, nautiloidea, var. globigeriniformis, 102.
lobata, Bolivina, 134.
lobatula, Truncatulina, 60, 208.
,, var. arenacea, Truncatulina, 208
lobatulus, Nautilus, 208.
longicollis, Polymorphina, 183.
longiscata, Nodosaria, 95.
longiscatiformis, Reophax, 95.
longispina, Lagena, 143.
lucida (var.), Entosolenia, 154
,, Lagena, 154.
,, Spirillina, 196.
lucifuga, Nubecularia, 60.
,, var. decorata, Nubecularia, 60.
lucernula, Biloculina, 61.
lyellii, Amphorina, 146.
,, Lagena, 146.

macella, Polystomella, 230.

macellus, Nautilus, 230.
malcomsonii, Lagena, 155.
,, (var.) Lagena, 155.
mamilla, Crithionina, 105.
margaritifera, Spirillina, 197.
margaritiferum, Ophthalmidium, 72.
marginata, Bulimina, 128.
,, Lagena, 156.
,, Serpula, 156.
,, var. fissa, Lagena, 157.
,, var. inaequilateralis, Lagena, 157.
,, var. semimarginata, Lagena, 157.
marginato-perforata, Lagena, 158.
Marginulina costata (Batsch), 176.
,, glabra, d'Orb., 176.
,, striatula, 176.
,, tenuis, 177.
mariae, Textularia, 118.
Marsipella chapmani, nom. nov., 90.
,, cylindrica, Br., 90.
,, elongata, Norm., 90.
,, spiralis, 80.
Masonella, 80.
mediterranensis, Discorbina, 201.
,, Planorbulina, 207.
,, Rosalina, 201.
megaspira, Ammodiscus, 110.
melo, Lagena, 152.
,, Oolina, 152.
,, Technitella, 106.
membranacea, Reophax, 168.
menardii, var. tumida, Pulvinulina, 215.
mestayeri, Ammodiscus, 109.
,, Hyperammina, 87.
,, Technitella, 89.
micheliniana, Rotalina, 216.
Miliola elongata, 144.
,, ovum, 143.
Miliolina agglutinans (d'Orb.), 69.
,, alveoliniformis, 66.
,, auberiana (d'Orb.) [also R. d. J.], 68.
,, ,, var. arenacea, nov [R. d. J.], 232.
,, bosciana (d'Orb.), 66.
,, brongniartii (d'Orb.), 71.
,, bucculenta, Br., 65.
,, calcarata, sp. nov., 68.
,, candeiana (d'Orb.), 68.
,, chrysostoma, Chap., 64.
,, circularis (Born.), 64, 234.
,, ,, var. sublineata, Br., 64.
,, contorta (d'Orb.), 69.
,, cristata, 68.
,, cuvieriana (d'Orb.), 69.
,, excisa, 68.
Miliolina ferussacii (d'Orb.), 70.
,, fusca (Br., 69.
,, gracilis (d'Orb.), 67.
,, insignis (Br.), 65.
,, labiosa (d'Orb.), 65.
,, linnaeana (d'Orb.), 71.
,, oblonga (Mont.), 66.
,, ,, var. arenacea, Chap., 66.
,, polygona (d'Orb.), 70.
,, pygmaea (Rss.), 64, 67.
,, rotunda (d'Orb.) [K. I.], 231.
,, sclerotica (Karr.), 70.
,, seminulum (Linn.), 67.
,, subrotunda (Mont.), 65.
,, tricarinata (d'Orb.), 66.
,, trigonula (Lam.), 65.
,, valvularis (Rss.), 64.
,, venusta (Karr.), 68.
Miliolites planulata, 63.
,, ringens, 61.
,, trigonula, 65.
Millepora miniacea, 221.
milletti, Textularia, 118.
millettii, Discorbina, 199.
miniacea, Millepora, 221.
miniaceum, Polytrema, 221.
,, var. alba, Polytrema, 226.
minuta, Saccammina, 85.
minutissima, Discorbina, 202.
mitrata, Trochammina, 113.
monile, Orthoceras, 172.
moniliformis, Trochammina, 112.
monilis, Nodosaria, 172.
mucronata, Dentalina, 170.
,, Nodosaria, 170.
multicosta, Fissurina, 148.
,, Lagena, 148.
murrhyna (var.), Biloculina, 62.

nana, Trochammina, 101.
nanum, Haplophragmium, 101.
Nautilus acutauricularis, 178.
,, ammonoides, 230.
,, asterizans, 226.
,, auricula, 214.
,, beccarii, 219.
,, calcar, 180.
,, cassis, 233.
,, comatus, 171.
,, costatus, 176, 180.
,, crepidula, 177.
,, crispus, 229.
,, depressulus, 226.
,, faba, 229.
,, inflatus, 112.

Nautilus legumen, 176.
,, lobatulus, 208.
,, macellus, 230.
,, obliquus, 171.
,, pompilioides, 227.
,, radicula, 168.
,, raphanistrum, 171.
,, repandus, 213.
,, scalaris, 171.
,, scapha, 228.
,, striato-punctatus, 229.
,, umbilicatulus, 227.
,, vertebralis, 172.
,, vortex, 179.
nelsoni (var.), Lagena, 148.
nitida, Discorbina, 199.
,, Rotalina, 199.
,, Spiroloculina, 63.
,, Trochammina, 112.
nitidula, Cassidulina, 140.
,, Pulvinulina, 140.
nobilis, Bolivina, 233.
nodosa, Nodosaria, 231.
Nodosaria adolphina (d'Orb.), 172.
,, calomorpha, Rss., 168.
,, catenulata, Br., 172.
,, comata (Batsch), 171.
,, communis, d'Orb., 95, 169.
,, consobrina, d'Orb., 170.
,, ,, var. emaciata, Rss., 170.
,, farcimen (Sold.), 95, 168.
,, filiformis, d'Orb., 95, 169.
,, gracilis (Neugeb.), 169.
,, hispida, d'Orb. 171.
,, inflexa, 59, 96.
,, laevigata, d'Orb., 167.
,, longiscata, 95.
,, monilis, 172.
,, mucronata (Neugeb.), 170.
,, nodosa, 231.
,, obliqua (Linn.), 171.
,, pauperata, d'Orb., 94, 170.
,, pellita, sp. nov., 173.
,, pyrula, d'Orb., 168, 173.
,, radicula (Linn.), 168.
,, raphanistrum (Linn.), 171.
,, roemeri (Neugeb.), 170.
,, rotundata (Rss.), 167.
,, scalaris (Batsch), 171.
,, setosa, 171.
,, simplex (O. Silv.), 168.
,, soluta, Rss., 93, 95, 169.
,, subtertenuata, Schw., 170.
,, vertebralis (Batsch), 172.
nodulosa, Reophax, 95.
Nonionina asterizans (F. & M.)., 226.
,, boueana, d'Orb., 227.
,, ,, var. janiformis, 101.
,, canariensis, 100.
,, communis, d'Orb., 228.
,, depressula (W. & J.), 100, 226.
,, latidorsata, 99.
,, pauperata, Balk. & Wright, 228.
,, pelagica, 193.
,, pompilioides (F. & M.), 99, 227.
,, quinqueloba, 193.
,, scapha (F. & M.), 228.
,, sloanii, 228.
,, sphaeroides, 194.
,, stelligera, d'Orb., 227.
,, turgida (Will.), 228.
,, ,, var. arenacea, nov., 228.
,, umbilicatula (Mont.), 100, 227.
Nouria harrisii, H.-A. & E., 103.
,, polymorphinoides, H.-A. & E., 103.
novae-zealandiae, Hyperammina, 89.
,, Spirillina, 196.
Nubecularia bradyi, Mill., 60.
,, inflata, 60.
,, lucifuga, Def., 60, 95, 103, 208.
,, ,, var. decorata, H. - A. & E., 60.
,, tibia, J. & P., 59, 95.
,, tubulosa, H.-A. & E., 60.
nuda (var.), Lagena, 159.

obconica, Spirillina, 195.
,, var. carinata, Spirillina, 195
obliqua, Nodosaria, 171.
obliquiloculata, Pullenia, 193.
obliquus, Nautilus, 171.
oblonga, Cassidulina, 138.
,, Miliolina, 66.
,, Polymorphina, 180.
,, (var.), Polymorphina, 180.
,, Pulvinulina, 214.
,, var. arenacea, Miliolina, 66.
oblongum, Vermiculum, 66.
obscura, Clavulina, 126.
obsoleta, Bolivina, 136.
,, Textularia, 136.
obtusa, Discorbina, 202.
,, Jaculella, 86.
,, Rosalina, 202.
occlusa (var.), Lagena, 166.
ochracea, Rotalina, 111.
,, Trochammina, 111.
oligogyra, Cornuspira, 196.
omphalotetras, Globigerina, 190.
Oolina apiculata, 143.

Oolina clavata, 231.
,, fasciata, 155.
,, melo, 152.
,, striata, 145.
opercularis, Rosalina, 203.
,, Discorbina, 203.
Operculina ammonoides (Gron.), 230.
,, incerta, 109.
Ophthalmidium margaritiferum, sp. nov., 72.
,, tumidulum, 73.
orbicularis, Cristellaria, 179.
,, Cyclammina, 116.
,, Discorbina, 200.
,, Gyroidina, 219.
,, Robulina, 179.
,, Rosalina, 200.
,, Rotalia, 219.
orbignyana, Fissurina, 161.
,, Lagena, 161.
,, var. alata, Lagena, 235.
,, ,, baccata, Lagena, 162.
,, ,, concentrica, Lagena, 162.
,, ,, coronata, Lagena, 163.
,, ,, selseyensis, Lagena, 162.
,, ,, unicostata, Lagena, 163.
,, ,, walleriana, Lagena, 162.
,, ,, yokoyamae, Lagena, 163.
Orbis foliaceus, 73.
Orbitolina annularis, 198.
,, vesicularis, 221.
Orbulina bilobata, 193.
,, porosa, 193.
,, universa, d'Orb., 107, 193.
Orthoceras arthrocena, 172.
,, comatus, 171.
,, farcimen, 168.
,, monile, 172.
,, scalaris, 171.
,, vertebralis, 172.
ornata (var.), Entosolenia, 159.
,, Lagena, 159.
,, Spirillina, 196.
ovata, Bulimina, 128.
,, Polymorphina, 181.
,, Sigmoilina, 70.
ovicula, Hormosina, 168.
oviformis, Gromia, 59.
ovoidea, Chilostomella, 142.
ovulum, Reophax, 143.
ovum, Lagena, 143.
,, Miliola, 143.

pachyderma, Aristerospira, 190.
,, Globigerina, 190.
pannosa, Lagena, 235.
papillata, Thurammina, 75, 107.
,, var. albicans, Thurammina, 107.
,, ,, castanea, Thurammina, 107.
,, ,, favosa, Thurammina, 107.
,, ,, haeusleri, Thurammina, 107.
papillosa, var. compressiuscula, Rotalia, 220.
paradoxa (var.), Lagena, 150.
parallela (var.), Vaginulina, 176.
parasitica, Amphicoryne, 179.
pariana, Gaudryina, 123.
parisiensis, Clavulina, 126.
,, Discorbina, 203.
,, Rosalina, 203.
parkeriana, Cassidulina, 139.
partschiana, Pulvinulina, 218.
,, Rotalina, 218.
parva, Psammosphaera, 83.
patagonica, Pulvinulina, 215.
,, Rotalina, 215.
,, var. scitula, Pulvinulina, 215.
Patellina corrugata, Will., 198.
,, ,, var. annularis (P. & J.), 198.
,, plicata, 112.
patelliformis, Discorbina, 204.
paucicostata, Cristellaria, 180.
pauciloculata, Ammochilostoma, 114.
,, Trochammina, 114.
,, Virgulina, 132.
paucisepta, Cristellaria, 178.
pauperata, Dentalina, 170.
,, Nodosaria, 170.
,, Nonionina, 228.
,, Pulvinulina, 217
pavonia, Cuneolina, 232.
pectinata, Textularia, 118.
pelagica, Hastigerina, 193.
,, Nonionina, 193.
pellucida, Seabrookia, 141.
Pelosina cylindrica, Br., 77.
,, rotundata, Br., 77.
,, variabilis, Br., 77.
pendulum (var.), Lagena, 166.
perlucida, Rotalia, 219.
peruviana, Discorbina, 200.
perlucida, Rotalia, 219.
,, Rosalina, 200.
pileolus, Discorbina, 204.
,, Valvulina, 204.
pilulifera, Reophax, 93.
pisum, Crithionina, 106.
,, var. hispida, Crithionina, 106.
Placopsilina aggregata, 75.
,, bulla, 104.
,, cenomana, d'Orb., 103.
,, intermedia, 75.

Placopsilina kingsleyi, Siddall, 103.
Planispirina celata, 71.
,, cliarensis, H.-A. & E., 73.
,, edwardsi, 71.
,, exigua, 73.
,, sigmoidea, 71.
plano-convexa, Discorbina, 209.
Planorbulina acervalis, Br., 207.
,, culter, 211.
,, mediterranensis, d'Orb., 207
planulata, Miliolites, 63.
,, Spiroloculina, 63.
Plecanium concavum, 117.
,, rugosum, 118.
placenta, Reophax, 157.
Pleurostomella subnodosa, Rss. [T. d. F.], 231.
plicata, Bolivina, 135.
,, Patellina, 112.
,, Trochammina, 112.
plumigera, Lagena, 147.
poeyi, Cymbalopora, 198.
polyeides, Reophax, 171.
polygona, Miliolina, 70.
,, Quinqueloculina, 70.
polygyra, Cornuspira, 195.
polymorpha, Anomalina, 212.
Polymorphina angusta, Egger, 181.
,, communis, d'Orb., 182.
,, compressa, d'Orb., 103, 182.
,, elegantissima, P. & J., 182.
,, gibba, d'Orb., 181.
,, inflata, 182.
,, lactea (W. & J.), 180.
,, lanceolata, Rss., 181, 183.
,, longicollis, Br., 183.
,, oblonga, Will., 103, 180.
,, ovata, d'Orb., 181.
,, problema, d'Orb., 182.
,, rotundata (Born.), 182.
,, sororia, Rss., 181.
polymorphinoides, Nouria, 103.
polyrraphes, Discorbina, 201.
,, Rotalina, 201.
Polystomella crispa (Linn.), 229.
,, decipiens, Costa, 229.
,, faba (F. & M.), 229.
,, macella (F. & M.), 230.
,, striato-punctata (F. & M.), 229.
,, ,, ,, var. selseyensis H.-A. & E., 229.
,, subnodosa (Münster), 229.
polystropha, Bulimina, 124.
,, Verneuilina, 124.
Polytrema miniaceum (Linn.), 221.
,, ,, var. alba, Carter, 226.
pompilioides, Nautilus, 227.
,, Nonionina, 227.
porosa, Orbulina, 193.
porrecta, Bifarina, 132.
,, Textularia, 119.
,, (var.), Textularia, 119.
,, var. arenacea, Bifarina, 132.
praecincta, Rotalia, 211.
,, Truncatulina, 211.
praegeri, Discorbina, 199.
problema, Polymorphina, 182.
procera, Pulvinulina, 217.
propinqua, Verneuilina, 125.
protea, Lagena, 153.
proteiformis, Carpenteria, 213.
,, (var.), Carpenteria, 213.
proteus, Trochammina, 112, 113.
Psammonyx vulcanicus, 110.
Psammosphaera bowmanni, H.-A. & E., 83.
,, fusca, Schulze, 83.
,, ,, var. testacea, Flint, 83.
,, parva, Flint, 83.
,, rustica, H.-A. & E., 84.
pseudodistans (var.), Reophax, 95.
pseudospirale, Haplophragmium, 97.
pseudospiralis, Proteonina, 97.
pulchella, Lagena, 165.
,, var. hexagona, Lagena, 165.
Pullenia obliquiloculata, P. & J., 193.
,, quinqueloba, Rss., 193.
,, sphaeroides (d'Orb.), 194.
pulvinoides, Discorbina, 206.
Pulvinulina auricula (F. & M.), 214.
,, berthelotiana (d'Orb.), 218.
,, brongniartii (d'Orb.), 215.
,, canariensis (d'Orb.), 215.
,, concentrica, P. & J., 214.
,, crassa (d'Orb.), 216.
,, elegans (d'Orb.), 218.
,, erinacea, 206.
,, exigua, Br., 217.
,, favus, Br., 219.
,, haliotidea, H.-A. & E., 215.
,, hauerii (d'Orb.), 214.
,, karsteni (Rss.), 217, 218.
,, nitidula, 140.
,, oblonga (Will.), 214.
,, partschiana (d'Orb.), 218.
,, patagonica (d'Orb.), 215.
,, ,, var. scitula, Br., 215.
,, pauperata, P. & J., 217.
,, procera, Br., 217.
,, punctulata (d'Orb.), 214.
,, pygmaea, 211.
,, repanda (F. & M.), 213.

Pulvinulina repanda, var. concamerata (Mont.), 213.
,, schreibersii (d'Orb.), 217.
,, truncatulinoides (d'Orb.), 216.
,, tumida, Br., 215.
,, umbonata, Rss., 216.
punctata, Bolivina, 132.
,, var. arenacea, Bolivina, 133.
punctulata, Pulvinulina, 214.
,, Rotalia, 214.
pupoides, Gaudryina, 122.
,, Bulimina, 127.
pusilla, Cyclammina, 115.
,, Verneuilina, 125.
pustulata, Discorbina, 203.
pygmaea, Bolivina, 135.
,, Bulimina, 125.
,, Frondicularia, 174.
,, Miliolina, 64, 67.
,, Pulvinulina, 211.
,, Quinqueloculina, 67.
,, Truncatulina, 211.
,, Uvigerina, 183.
,, Verneuilina, 125.
Pyrgo laevis, 232.
pyrula, Bulimina, 127.
,, Nodosaria, 168.

quadrangularis, Lagena, 160.
quadrata (var.), Entosolina, 155.
,, Lagena, 155.
quadri-auriculata (var.), Lagena, 167.
quadrilatera, Textularia, 136.
quinquelatera, Lagena, 160.
quinqueloba, Nonionina, 193.
,, Pullenia, 193.
Quinqueloculina agglutinans, 69.
,, auberiana, 68.
,, bosciana, 66.
,, candeiana, 68.
,, contorta, 69.
,, cuvieriana, 69.
,, denticulata, 68.
,, ferussacii, 70.
,, fusca, 69.
,, gracilis, 67.
,, polygona, 70.
,, pygmaea, 67.
,, sclerotica, 70.
,, tenuis, 63.
,, venusta, 68.

racemosa, Ramulina, 187.
radiata, Fissurina, 159.
radicula, Nautilus, 168.
,, Nodosaria, 168.
ramosa, Hyperammina, 86.
Ramulina grimaldii, 187.
,, globulifera, Br., 186.
,, (?) 187.
,, racemosa, 187.
raphanistrum, Nautilus, 171.
,, Nodosaria, 171.
raphanus, Dimorphina, 186.
,, Sagrina, 186.
,, Technitella, 89.
rarescens, Discorbina, 203.
raricostata (var.), Lagena, 157.
recta, var. parallela, Vaginulina, 176.
refulgens, Cibicides, 207.
,, Truncatulina, 207.
regularis, Terebralina, 111.
reniformis, Lagena, 155.
Reophax adunca, Br., 96.
,, advena, Cush., 94.
,, ampullacea, Br., 93, 103, 153, 157.
,, bacillaris, Br., 94, 170.
,, cylindrica, Br., 97.
,, dentaliniformis, Br., 94.
,, difflugiformis, Br., 92, 143, 144..
,, distans, Br., 59, 96.
,, euncta, Jensen, 96.
,, fusiformis (Will.), 93.
,, grandis, 157.
,, guttifera, Br. [D.], 168, 234.
,, lageniformis, 153.
,, lenticularis, 157.
,, longiscatiformis, Chap., 95.
,, membranacea, 168.
,, nodulosa, Br., 95, 168.
,, ovulum, 143.
,, pilulifera, Br., 93, 169.
,, placenta, 157.
,, polyeides, 171.
,, scorpiurus, Mont., 93.
,, spiculifera, Br., 60, 95, 169.
,, ,, var. pseudodistans, 96.
repanda, Pulvinulina, 213.
,, var. concamerata, Pulvinulina, 213.
repandus, Nautilus, 213.
reticulata, Bolivina, 135.
,, Lagena, 152.
,, Lagenula, 152.
,, Rotalina, 212.
,, Truncatulina, 212.
reussi, Frondicularia, 175.
Rhabdammina abyssorum, M. Sars, 91.
,, cornuta, 84.
,, discreta, Br., 91.

Rhabdogonium tricarinatum (d'Orb.), 175.
Rhizammina algaeformis, Br., 92.
richardi, Dioxeia, 90.
ringens, Biloculina, 61.
,, Miliolites, 61.
,, Trochammina, 114.
rizzae, Fissurina, 160.
,, Lagena, 160.
robertsoni, Trochammina, 114.
robertsoniana, Truncatulina, 210.
Robulina articulata, 179.
,, orbicularis, 179.
,, subnodosa, 229.
Robulus cultratus, 180.
robusta, Bolivina, 136.
roemeri, Dentalina, 170.
,, Nodosaria, 170.
rosacea, Discorbina, 200.
,, Rotalina, 200.
Rosalina akneriana, 210.
,, bertheloti, 202.
,, bulloides, 199.
,, cora, 199.
,, globularis, 201.
,, isabelleana, 199.
,, mediterranensis, 201.
,, obtusa, 202.
,, opercularis, 203.
,, orbicularis, 200.
,, parisiensis, 203.
,, peruviana, 200.
,, rugosa, 202.
,, saulcii, 202.
,, valvulata, 202.
,, vilardeboana, 200.
rostrata, Bulimina, 129.
Rotalia beccarii (Linn.), 219.
,, brongniartii, 215.
,, clathrata, Br., 220.
,, craticulata, P. & J., 220.
,, karsteni, 218.
,, ochracea, 111.
,, orbicularis (d'Orb.), 219.
,, papillosa, var. compressiuscula, Br.., 220.
,, perlucida, H.-A. & E., 219.
,, praecincta, 211.
,, punctulata, 214.
,, soldanii, d'Orb., 219.
,, ,, var. arenacea, nov., 220.
,, squammosa, 198.
,, turbo, 200.
rotaliformis, Trochammina, 114.
Rotalina berthelotiana, 218.
,, canariensis, 215.
,, crassa, 216.
Rotalina dutemplei, 211.
,, elegans, 218.
,, fusca, 125.
,, haidingerii, 210.
,, hauerii, 214.
,, micheliniana, 216.
,, nitida, 199.
,, partschiana, 218.
,, patagonica, 215.
,, polyrraphes, 201.
,, reticulata, 212.
,, rosacea, 200.
,, schreibersii, 217.
,, truncatulinoides, 216.
,, turgida, 228.
,, umbonata, 216.
,, ungeriana, 210.
rotulata, Cristellaria, 179.
,, Lenticulites, 179.
rotulatum, Haplophragmium, 99.
,, Haplophragmoides, 99.
rotunda, Miliolina, 231.
,, Triloculina, 231.
rotundata, Crithionina, 106.
,, Glandulina, 167.
,, Guttulina, 182.
,, Nodosaria, 167.
,, Pelosina, 77.
,, Polymorphina, 182.
rubra, Globigerina, 191.
,, var. elevata, 191.
rudis, Lagena, 144.
rufum, Bathysiphon, 82.
rugosa, Crithionina, 77, 106.
,, Discorbina, 202.
,, Gaudryina, 122.
,, Rosalina, 202.
,, Textularia, 118.
,, Webbina, 59.
rugosum, Plecanium, 118.
rustica, Psammosphaera, 84

Saccammina minuta, 85.
,, sphaerica, M. Sars, 85, 94.
,, ,, var. anglica, 85.
sacculifera, Globigerina, 192.
Sagenina divaricans, 60.
,, frondescens, 60.
sagittula, Spiroplecta, 118.
,, Textularia, 118.
Sagraina affinis, 117.
Sagrina bifrons, Br., 186.
,, columellaris, Br., 185.
,, dimorpha (P. & J.), 186.

Sagrina raphanus, P. & J., 186.
,, striata (Schw.), 186.
,, virgula, Br. 186.
Saracenaria italica, 178.
saulcii, Discorbina, 202.
,, Rosalina, 202.
scabra, Gaudryina, 123.
scalaris, Nautilus, 171.
,, Nodosaria, 171.
,, Orthoceras, 171.
scapha, Nautilus, 228.
,, Nonionina, 228.
scarabaeus, Lagena, 161.
schlichti, Fissurina, 156.
,, Lagena, 156.
schloenbachi, Cristellaria, 177.
schreibersiana, Virgulina, 131.
schreibersii, Pulvinulina, 217.
,, Rotalina, 217.
scitula, Pulvinulina, 215.
,, (var.), Pulvinulina, 215.
scitulum, Haplophragmium, 99.
sclerotica, Miliolina, 70.
,, Quinqueloculina, 70.
scorpiurus, Reophax, 93.
scottii, Frondicularia, 175.
,, Lagena, 150.
scruposum, Haplophragmium, 92, 144.
Seabrookia earlandi, Wright, 141.
,, pellucida, Br., 141.
selseyensis, Cornuspira, 74.
,, (var.), Lagena, 162.
,, ,, Polystomella, 229.
,, Spirillina, 197.
semimarginata (var.), Lagena, 157.
seminiformis, Lagena, 158.
,, (var.), Lagena, 158.
seminuda (var.), Bulimina, 129.
,, Lagena, 153.
seminulum, Miliolina, 67.
,, Serpula, 67.
semistriata, Lagena, 147.
,, (var.), Lagena, 147.
Serpula concamerata, 213.
,, filum, 88.
,, lactea, 180.
,, laevis-globosa, 142.
,, marginata, 156.
,, seminulum, 67.
,, striata, etc., 146.
serrata (var.), Biloculina, 63.
,, Ehrenbergina, 140.
,, (var.), Miliolina, 69.
setosa, Nodosaria, 171.
shoneana, Trochammina, 110.
shoneana Turritella, 110.
shoneanus, Ammodiscus, 110.
sigmoidea, Planispirina, 71.
,, Sigmoilina, 71.
Sigmoilina celata (Costa), 71.
,, edwardsi (Schlumb.), 71.
,, ovata, Sideb., 70.
,, sigmoidea, Br., 71.
,, umbonata, sp. nov., 71.
simplex, Nodosaria, 168.
sinuosa, Anomalina, 213.
Siphogenerina bifrons, 186.
siphonella, Gaudryina, 123.
siphonifera, Spiroplecta, 119.
sloanii, Nonionina, 228.
soldanii, Rotalia, 219.
,, var. arenacea, Truncatulina, 220.
soluta, Dentalina, 169.
,, Nodosaria, 169.
sororia, Polymorphina, 181.
Sorosphaera confusa, Br., 84.
spathulata, Frondicularia, 174.
sphaera, Biloculina, 61.
sphaerica, Saccammina, 85.
sphaeriloculum, Haplophragmium, 101.
,, Haplophragmoides, 101.
sphaeroides, Nonionina, 194.
,, Pullenia, 194.
Sphacroidina bulloides, d'Orb., 102, 194.
,, dehiscens, P. & J., 194.
sphaeroidiniforme, Ammosphaeroidina, 102.
,, Haplophragmium, 102.
sphaerula, Lagena, 144.
spiculotesta (var.), Rhabdammina, 84.
spiculifera, Reophax, 60.
spinescens (var.), Bolivina, 133.
spinigera (var.), Lagena, 161.
spinipes (var.), Lagena, 150.
spinoso-marginata (var.), Lagena, 159.
spinulosa, Verneuilina, 124.
spiralis, Marsipella, 80.
Spirillina arenacea, 109.
,, decorata, Br., 197.
,, inaequalis, Br., 196.
,, limbata, Br., 196.
,, ,, var denticulata, Br., 197.
,, lucida, Sideb., 196.
,, margaritifera, Will., 197.
,, novae-zealandiae, Chap., 196.
,, obconica, Br., 195.
,, ,, var. carinata, Halk., 195.
,, ornata, Sideb., 196.
,, selseyensis, H.-A. & E., 197.
,, tuberculata, Br., 196, 197.
,, vivipara, Ehbg., 74, 109, 195.

Spirolina agglutinans, 97.
Spiroloculina affixa, Terq., 63.
,, arenaria, Br., 64.
,, excavata, d'Orb., 63.
,, inaequilateralis, 63.
,, nitida, d'Orb., 63.
,, planulata (Lam.), 63.
,, tenuis (Czj.), 63.
Spiroplecta annectens (P. & J.), 121.
,, biformis (P. & J.), 122.
,, siphonifera, 119.
,, wrightii (Silv.), 118.
spumosa, Lagena, 150.
squamata, Trochammina, 111.
squammigera, Bulimina, 131.
squammosa, Rotalia, 198.
squamosa, Lagena, 151.
squamoso-sulcata, Lagena, 151.
squamosum, Vermiculum, 151.
staphyllearia, Fissurina, 154.
,, Lagena, 154.
stelligera, Lagena, 148.
,, Nonionina, 227.
,, var. excentrica, Lagena, 148.
,, var. nelsoni, Lagena, 148.
Storthosphaera albida, Schulze, 77.
,, depressa, 77.
,, depressa, Pearcey [K. I.], 231.
striata, Dimorphina, 186.
,, Lagena, 145.
,, Oolina, 145.
,, Sagrina, 186.
,, Serpula, 146.
,, Textularia, 119.
striato-punctata, Lagena, 149.
,, (var.), Lagena, 149.
,, ,, selseyensis, Polystomella, 229.
striato-punctatus, Nautilus, 229.
striatula, Marginulina, 176.
striolata, Cornuspira, 75.
sub-depressa, Virgulina, 131.
subglobosa, Cassidulina, 138.
,, var. tuberculata, Cassidulina, 138.
sublineata (var.), Miliolina, 64.
subnodosa, Pleurostomella, 231.
,, Polystomella, 229.
,, Robulina, 229.
subrotunda, Miliolina, 65.
subrotundata, Gaudryina, 122.
subrotundum, Vermiculum, 65.
sub-squamosa, Virgulina, 131.
sub-striata (var.), Lagena, 167.
subteres, Bulimina, 130.
subtertenuata, Nodosaria, 170.
subturbinata, Trochammina, 188.
sulcata, Lagena, 146.

tabernacularis, Discorbina, 205.
Technitella legumen, Norm. [K.I.] 11.
,, melo, 106.
,, mestayeri, 89.
,, raphanus, 89.
tenera, Truncatulina, 211.
tenuimargo, Haplophragmium, 98.
,, Ammobaculites, 98.
,, Truncatulina, 209
,, var. alto-camerata, Truncatulina, 209.
tenuis, Ammodiscus, 74, 109.
,, Cristellaria, 177.
,, Marginulina, 177.
,, Quinqueloculina, 63.
,, Spiroloculina, 63.
tenuissima (var.), Hyperammina, 88.
tenuistriata (var.), Lagena, 158.
,, Uvigerina, 233.
Terebralina regularis, 111.
testacea (var.), Psammosphaera, 83.
textilarioides, Bolivina, 133.
,, var. arenacea, Bolivina, 234.
,, ,, spinescens, Bolivina, 133.
Textularia abbreviata, d'Orb., 120.
,, agglutinans, d'Orb., 119.
,, barrettii, P. & J. [R. d. J.], 232.
,, candeiana, d'Orb., 119.
,, catenata, 117.
,, concava (Karr.), 117.
,, ,, var. heterostoma, Forn., 102, 117.
,, conica, d'Orb., 121.
,, ,, var. horrida, Egger, 121.
,, fungiformis, Forn., 120.
,, fusiformis, 132.
,, gramen, d'Orb., 121.
,, horrida, 121.
,, inconspicua, Br., 117.
,, mariae, 118.
,, milletti, 118.
,, obsoleta, 136.
,, pectinata, 118.
,, porrecta, Br., 119.
,, quadrilatera, 136.
,, rugosa, Rss., 118.
,, sagittula, Def., 118.
,, ,, var. jugosa, 118.
,, stricta, 119.
,, triquetra, 124.

Textularia trochus, d'Orb., 121, 232.
,, variabilis, 135.
Textularioides inflata, 119.
Tholosina bulla (Br.), 104, 107.
Thurammina albicans, 108.
,, favosa, 107.
,, papillata, Br., 75, 84, 107, 193.
,, ,, var. albicans, Br., 108.
,, ,, ,, canaliculata, 85.
,, ,, ,, cariosa, 84.
,, ,, ,, castanea, H.-A. & E., 107.
,, ,, ,, elegantissima, 85.
,, ,, ,, favosa, Flint, 107.
,, ,, ,, haeusleri, H.-A. & E., 107.
,, ,, var. parallela, 108.
,, tuberosa, 108.
tibia, Nubecularia, 59.
tortuosa, Bolivina, 136.
,, var. arenacea, Bolivina, 136.
triangularis, Valvulina, 125.
tricarinata, Miliolina, 66.
,, Triloculina, 66.
,, Vaginulina, 175.
tricarinatum, Rhabdogonium, 175.
tricarinella, Cristellaria, 177.
trigonula, Miliolina, 65.
,, Miliolites, 65.
triloba, Globigerina, 187.
Triloculina brongniartii, 70.
,, circularis, 64.
,, echinata, 68.
,, labiosa, 65.
,, linneiana, 70.
,, rotunda, 231.
,, tricarinata, 66.
,, valvularis, 64.
Trioxeia edwardsi, 90.
triquetra, Textularia 124.
,, Verneuilina, 124.
Trochammina coronata, 112.
,, galeata, Br., 114.
,, globigeriniformis, 102.
,, globulosa, 189.
,, inflata (Mont.), 112, 114, 202.
,, irregularis clavata, 115.
,, mitrata, 113.
,, moniliformis, sp. nov., 112.
,, nana, 101.
,, nitida, Br., 112.
,, ochracea (Will.), 111.
,, pauciloculata, Br., 114.
,, plicata (Terq.), 112.
,, proteus, 112.
Trochammina ringens, Br., 114.
,, robertsoni, Br., 114.
,, rotaliformis, Wright, 114.
,, shoneana, 110.
,, squamata, J. & P., 111, 200.
,, ,, charoides, 110.
,, ,, gordialis, 110.
,, subturbinata, 188.
,, trullissata, Br., 113.
,, uviformis, Grzyb., 112, 221.
,, vesicularis, 114.
trochoides, Globigerina, 191.
trochus, Textularia, 121.
trullissata, Haplophragmium, 113.
,, Trochammina, 113.
Truncatulina akneriana (d'Orb.), 210.
,, colligera, 209.
,, culter (P. & J.), 211.
,, dutemplei (d'Orb.), 211.
,, haidingerii (d'Orb.), 210.
,, lobatula (W. & J.), 60, 208.
,, ,, var. arenacea, nov., 208.
,, praecincta (Karr.), 211.
,, pygmaea (Hant.), 211.
,, refulgens (Montf.), 207.
,, reticulata (Czj.), 212.
,, robertsoniana, Br., 210.
,, tenera, Br., 211.
,, tenuimargo, Br., 200.
,, ,, var. alto-camerata, nov., 200.
,, tumidula, Br., 211.
,, ungeriana (d'Orb.), 210.
,, variabilis, d'Orb.. 60, 101, 208.
,, wuellerstorfi (Schw.), 210.
truncatulinoides, Pulvinulina, 216.
,, Rotalina, 216.
tuberculata (var.), Cassidulina, 138.
,, Discorbina, 233.
,, Spirillina, 196, 197.
Tubinella inornata, 72.
tubulifera var. tenuistriata, Lagena, 158.
tubulosa, Nubecularia, 60.
tumida (var.), Cassidulina, 137.
,, Pulvinulina, 215.
,, (var.), Pulvinulina, 215
tumidula, Truncatulina, 211.
tumidulum, Ophthalmidium, 73.
turbo, Discorbina, 200.
,, Rotalia, 200.
turgida, Nonionina, 228.
,, Rotalina, 228
,, var. arenacea, Nonionina, 228.
turris, Verneuilina, 124.
Turritella shoneana, 110.

umbilicatula, Nonionina, 227.
umbilicatulus, Nautilus, 227.
umbonata, Pulvinulina, 216.
,, Rotalina, 216.
,, Sigmoilina, 71.
ungeriana, Rotalina, 210.
,, Truncatulina, 210.
unguiculata (var.), Discorbina, 207.
,, Lagena, 154.
unguis, Lagena, 157.
unicostata (var.), Lagena, 163.
unilatera (var.), Spirillina, 195.
universa, Orbulina, 193.
uviformis, Trochammina, 113.
Uvigerina aculeata, d'Orb., 184.
,, angulosa, Will., 183.
,, asperula, Czj., 184.
,, ,, var. ampullacea, Br., 184.
,, auberiana, d'Orb., 184.
,, ,, var. glabra, Mill., 185.
,, brunnensis, Karr., 184.
,, canariensis, d'Orb., 183.
,, dimorpha, 186.
,, interrupta, Br., 185.
,, pygmaea, d'Orb., 183.
,, tenuistriata, Rss. [R. d. J.], 233.

vagans, Hyperammina, 86.
Vaginulina bruckenthali, Neugeb., 176.
,, legumen (Linn.), 176.
,, recta, var. parallela, Halk., 176.
,, tricarinata, 175.
valvularis, Miliolina, 64.
,, Triloculina, 64.
valvulata, Discorbina, 202.
,, Rosalina, 202.
Valvulina alata, 134.
,, conica, P. & J., 125.
,, fusca (Will.), 111, 125, 200.
,, pileolus, 204.
,, triangularis, 125.
Vanhoeffenella gaussii, Rhumb., 76.
variabilis, Bolivina, 135.
,, Cristellaria, 177.
,, (var.), Haplophragmium, 100.
,, Pelosina, 77.
,, Textularia, 135.
,, Truncatulina, 60.
,, var. arenacea, Bolivina, 234.
ventricosa, Discorbina, 206.
,, Lagena, 154.
venusta, Hyperamminella, 88.
,, Miliolina, 68.
,, Quinqueloculina, 68.
Vermiculum laeve, 143.
,, oblongum, 66.
,, squamosum, 151.
,, subrotundum, 65.
Verneuilina polystropha (Rss.), 124, 126.
,, pusilla, Goës, 125.
,, propinqua, Br., 125.
,, pygmaea, Egger, 125.
,, spinulosa, Rss., 124.
,, triquetra (Münster), 124.
,, turris, sp. nov., 124.
vertebralis, Nautilus, Orthoceras, 172.
,, Nodosaria, 172.
vesicularis, Gypsina, 221.
,, Orbitolina, 221.
,, Trochammina, 114.
vilardeboana, Discorbina, 200.
,, Rosalina, 200.
villosa (var.), Lagena, 161.
virgula, Sagrina, 186.
Virgulina pauciloculata, Br., 132.
,, schreibersiana, Czj., 131.
,, sub-depressa, Br., 131.
,, sub-squamosa, Egger, 131.
vivipara, Spirillina, 74, 195.
,, var. carinata, Spirillina, 195.
vortex, Cristellaria, 179.
,, Nautilus, 179.
vulcanicus, Psammonyx, 110.

walleriana (var.), Lagena, 162.
Webbina clavata (J. & P.), 89, 115.
,, hemispherica, 75.
,, irregularis, d'Orb., 115.
,, laevigata, 115.
,, rugosa, 59.
williamsoni, Entosolenia, 146.
,, Lagena, 146.
williamsoniana, Bulimina, 130.
wilsoni, Discorbina, 206.
wrightiana, Gaudryina, 123.
wrightii, Spiroplecta, 118.
wuellerstorfi, Anomalina, 210.
,, Truncatulina, 210.

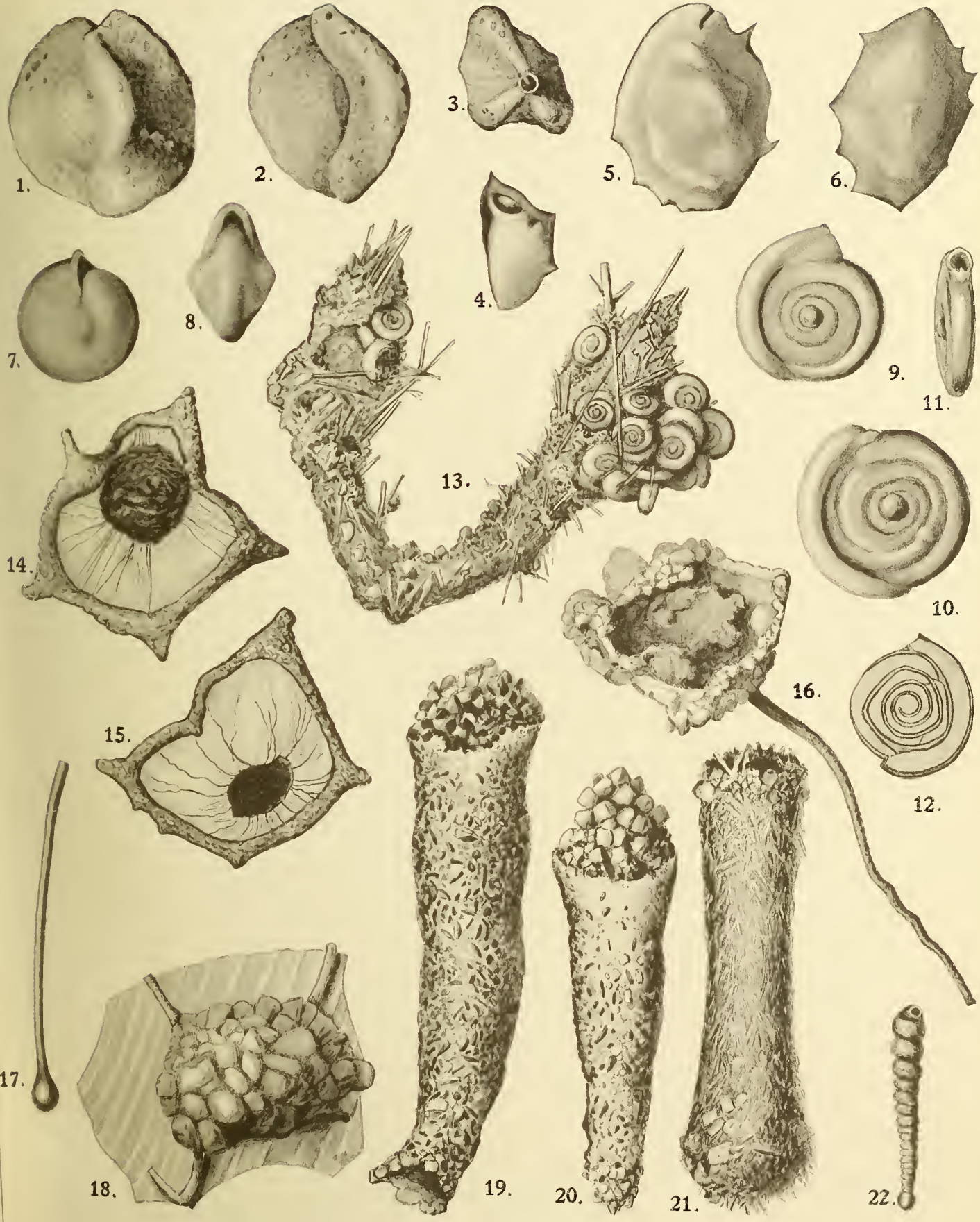
yokoyamae (var.), Lagena, 163.

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, DUKE STREET, STAMFORD STREET, S.E. 1, AND GREAT WINDMILL STREET, W. 1.

BRITISH MUSEUM (NATURAL HISTORY)

PLATE I.

	Magn.	No.
Fig. 1.—*Miliolina auberiana*, var. *arenacea* nov. Front view	75	636
Fig. 2.— ,, ,, ,, Back view	75	
Fig. 3.— ,, ,, ,, Oral view	75	
Fig. 4.—*Miliolina calcarata* sp. n. Oral view	90	41
Fig. 5.— ,, ,, ,, Front view	90	
Fig. 6.— ,, ,, ,, Back view	90	
Fig. 7.—*Sigmoilina umbonata* sp. n. Side view	45	53
Fig. 8.— ,, ,, ,, Oral view	45	
Figs. 9, 10.—*Ophthalmidium margaritiferum* sp. n. Side views	82	58
Fig. 11.— ,, ,, ,, Oral view	82	
Fig. 12.— ,, ,, ,, Side view (Balsam mount)	75	
Fig. 13.—*Hyperammina ramosa*, Brady, with incorporated specimens of *Cornuspira involvens*, Reuss.	45	91
Figs. 14, 15.—*Vanhoeffenella gaussii*, Rhumbler, showing the protoplasmic body	75	69
Fig. 16.—*Saccammina sphaerica*, M. Sars. Abnormal individual	16	87
Fig. 17.—*Hyperammina elongata*, var. *tenuissima* nov.	45	95
Fig. 18.—*Psammosphaera fusca*, Schulze. Sessile individual with tubular extensions	22	81
Fig. 19.—*Jaculella acuta*, Brady (?) Megalospheric form	11	88
Fig. 20.— ,, ,, ,, (?) Microspheric form	18	
Fig. 21.—*Hyperammina elongata*, Brady, utilising spicules for construction	23	93
Fig. 22.—*Ammodiscus shoneanus*, Siddall	75	159



M. H. Brooks. del. ad nat.

London Stereoscopic Co., imp.

BRITISH MUSEUM
NATURAL HISTORY

PLATE II.

DENDRONINA, gen. n.

FIGS. 1–6. *Dendronina limosa*, sp.n. No. 76.

FIG. 1.—A sessile specimen with globular basal chamber and two tubes arising from it (tubes broken).

FIG. 2.—Basal chamber of a free specimen with *cheval-de-frise* of spicules.

FIG. 3.—A young individual showing constriction of tube to form a nipple-shaped aperture (unbroken) and basal spicules.

FIG. 4.—A similar specimen with three trunks, laid open at base to show rudimentary labyrinthic structure.

FIG. 5.—A young individual to show constriction of apertural end of tube (unbroken). The oval bodies are sterrasters of a *Geodia*, and the specimen was probably sessile on the sponge.

FIG. 6.—Superior view of a sessile specimen with irregularly globular basal chamber. The central space shows the line of fracture of a double trunk arising from the basal chamber and indicates the thickness of the wall of the chamber.

FIGS. 7–9. *Dendronina limosa*, var. *humilis*, nov. No. 77.

FIG. 7.—Section showing labyrinthic base, swollen cavity of trunk above it, and simple tube with constricted aperture at the top.

FIG. 8.—Basal view, showing labyrinthic structure.

FIG. 9.—Side view, showing constricted simple aperture at the end of the short trunk.

FIGS. 10–12, 14–18. *Dendronina arborescens*, sp.n. No. 74.

FIG. 10.—A young sessile specimen with regularly formed basal pad and slender trunk (fragment).

FIGS. 11, 16.—Free growing specimens showing the bulbous basal chamber.

FIG. 12.—Semi-diagrammatic restoration of large specimen.

A.—The basal pad; B.—The trunk or principal tube; C.—A secondary tube with terminal corona of spines around aperture; D.—A similar terminal aperture on a branch; E.—Branches subdividing into branchlets; F.—Abnormal terminal with spicular extensions.

FIG. 14.—A branchlet characterised by the abnormal size of the spicules employed. Terminal aperture with spicular extensions at the top.

FIG. 15.—A fragment of a branch showing spiral arrangement of spicules.

FIG. 17.—The basal pad viewed as a transparent object. The darker radiating lines indicate protoplasm filling the radiating passages which converge on the central cavity from which the main trunk arises.

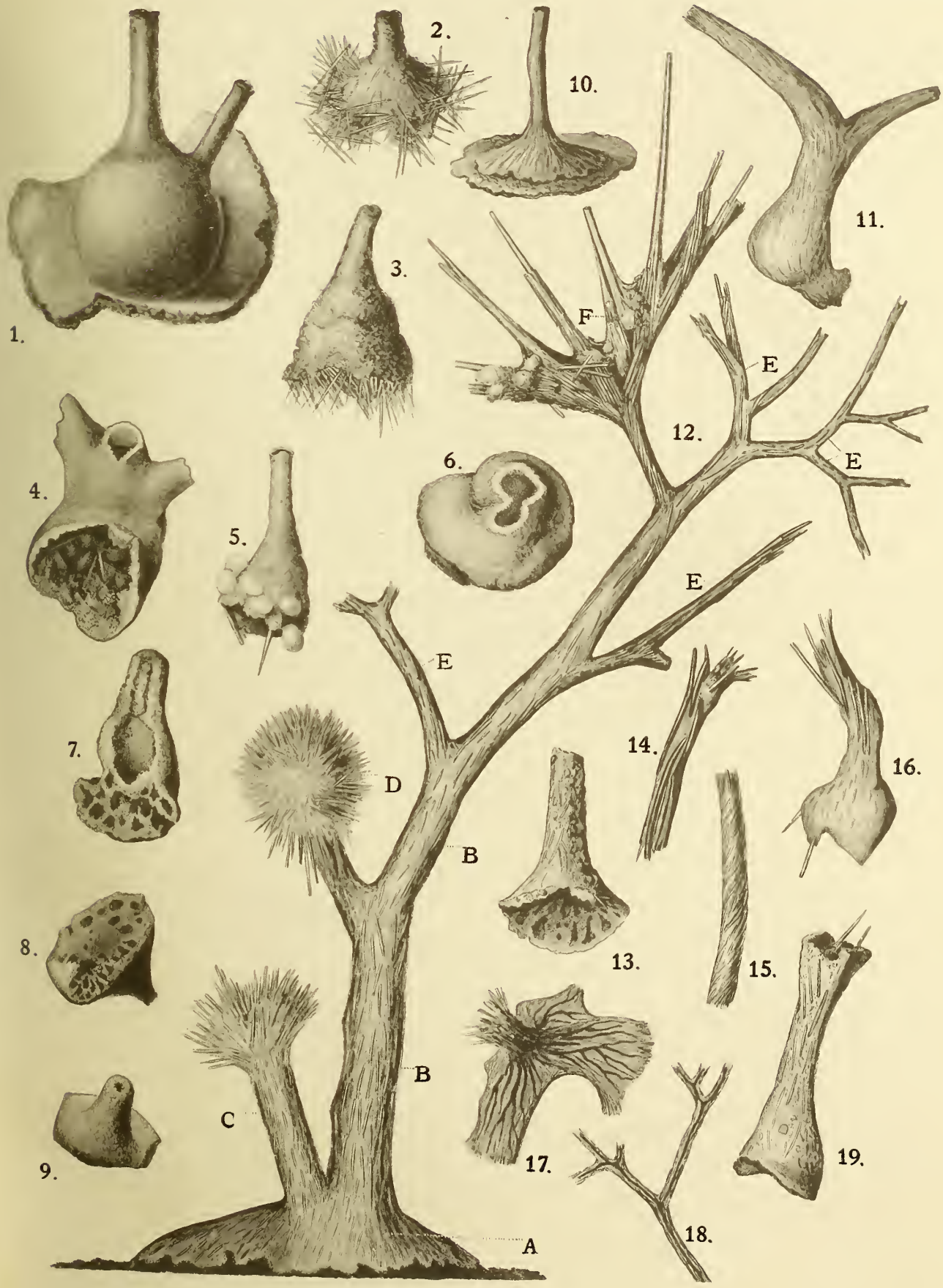
FIG. 18.—A branchlet viewed as a transparent object showing the continuity of the protoplasm.

FIGS. 13, 19. *Dendronina arborescens*, var. *antarctica*, nov. No. 75.

FIG. 13.—Detached sessile specimen showing labyrinthic structure of basal pad.

FIG. 19.—The incurved base shows that the specimen was originally sessile, and the broken top end of the trunk suggests a fracture at the point of furcation.

Magn. × 25.



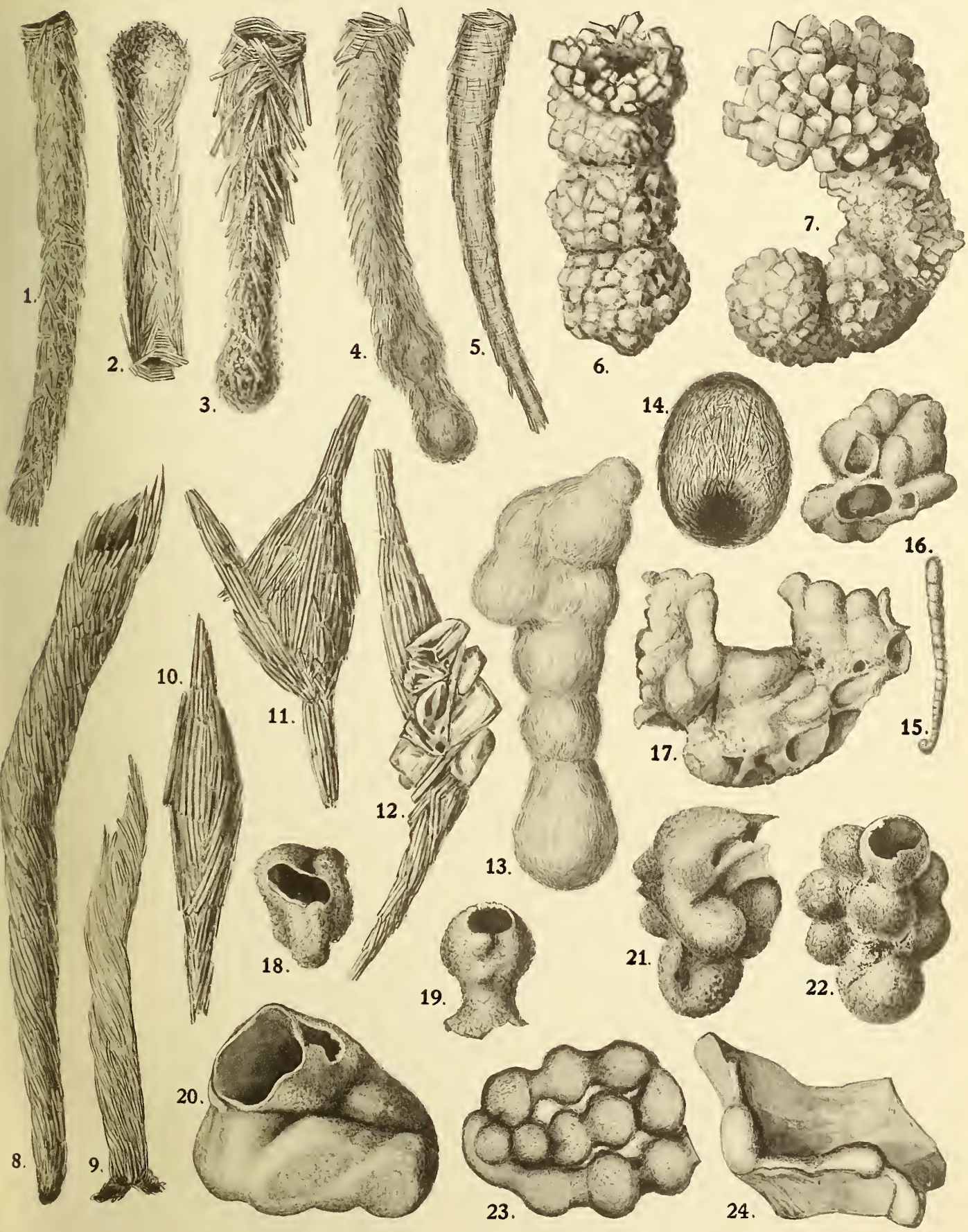
M.H. Brooks, del. ad nat.

London Stereoscopic Co., imp.

BRITISH MUSEUM
Z
D
7
NATURAL HISTORY

PLATE III.

		Magn.	No.
Fig. 1.—*Hyperammina novae-zealandiae*, sp.n.	Mierospherie	23	96
Figs. 2, 3.— ,, ,, ,,	Megalospherie	32	
Fig. 4.— ,, ,, ,,	,, Balsam mount showing rudimentary septation		
Fig. 5.— ,, ,, ,,	Mierospheric. Balsam mount		
Fig. 6.—*Reophax advena*, Cushman.	Straight type, final chamber incomplete.	18	108
Fig. 7.— ,, ,, ,,	Curved type, showing loosely agglutinated final chamber	18	
Fig. 8.—*Marsipella chapmani*, sp.n.		9	99
Fig. 9.— ,, ,, ,,	Balsam mount, showing basal extrusions of protoplasm	9	
Figs. 10, 11, 12.—*Marsipella elongata*, Norman		64	97
Fig. 13.—*Reophax euneta*, Jensen.	Abnormal specimen with supplementary chambers	16	114
Fig. 14.— ,, ,, ,,	Monothalamous specimen. Balsam mount showing protoplasm	40	
Fig. 15.—*Haplophragmium agglutinans* (d'Orbigny).	Pauperate type	72	118
Figs. 16, 17.—*Trochammina uviformis*, Grzybowski		54	166
Figs. 18, 19.—*Trochammina moniliformis*, sp.n.	Fragments showing aperture	72	165
Fig. 20.— ,, ,, ,,	Unseptate fragment	72	
Fig. 21, 22.— ,, ,, ,,	General aspect of type specimens	72	
Fig. 23.— ,, ,, ,,	Balsam mount	50	
Fig. 24.—*Webbina irregularis*, d'Orbigny		40	174



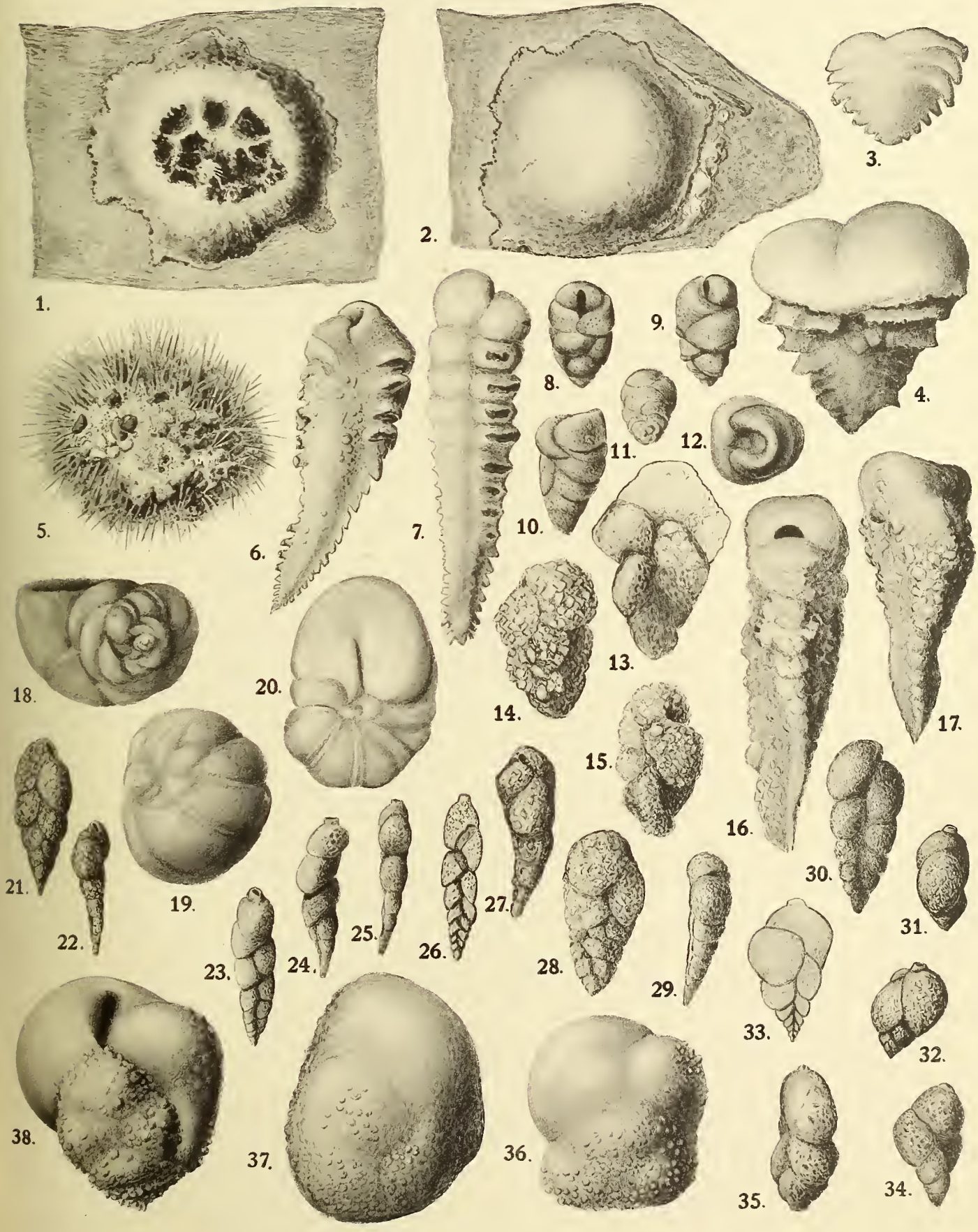
M. H. Brooks. del. ad nat.

London Stereoscopic Co., imp.

BRITISH MUSEUM
NATURAL HISTORY

PLATE IV.

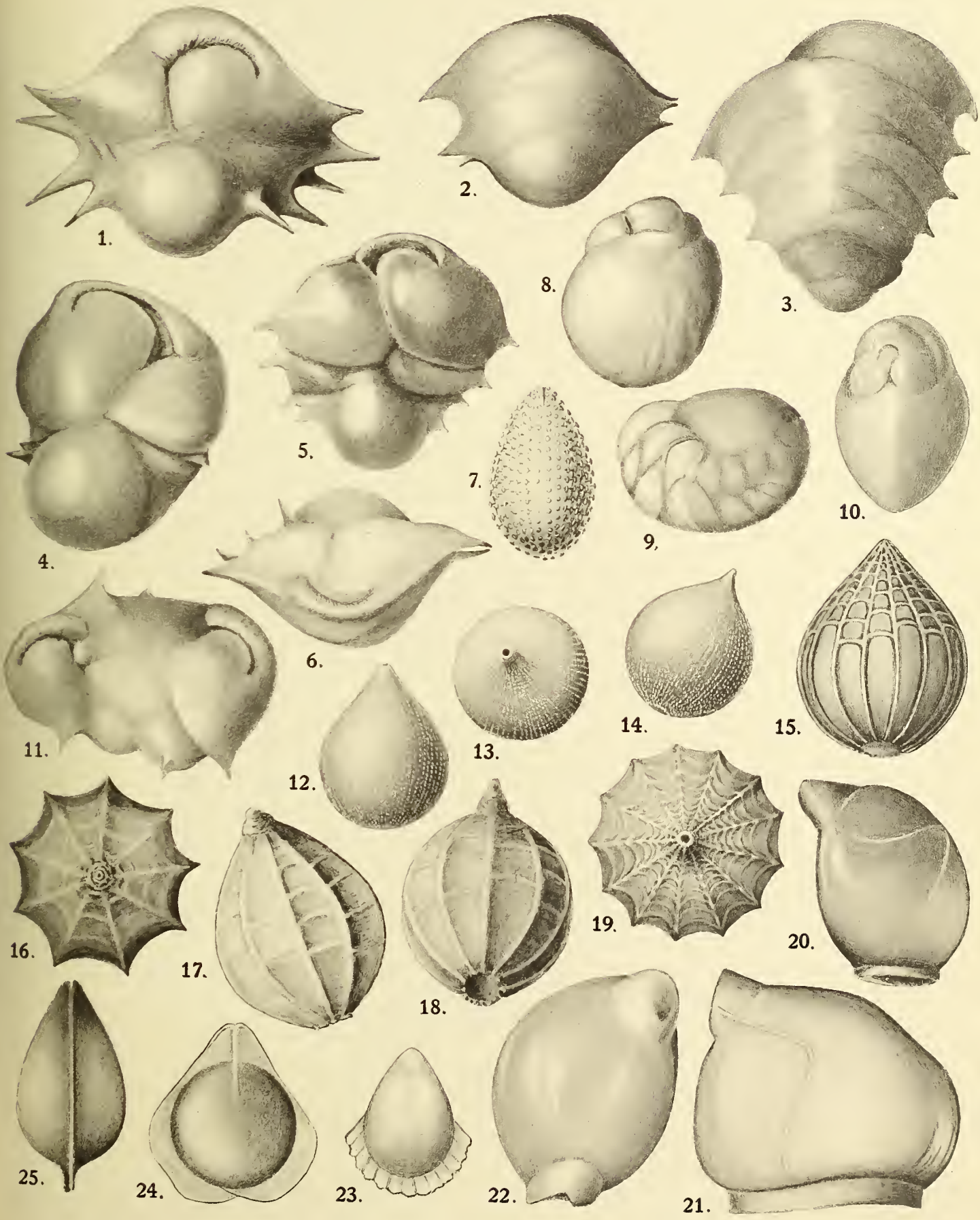
	Magn.	No.
Fig. 1.—*Crithionina lens*, Goës. Sessile. Laid open to show the rudimentary septation	22	147
Fig. 2.— ,, ,, Sessile specimen	22	
Figs. 3, 4.—*Textularia conica*, var. *horrida*, Egger.	90	190
Fig. 5.—*Crithionina rugosa*, hispid variety.	27	146
Figs. 6, 7.—*Textularia porrecta*, Brady	27	185
Figs. 8, 9, 10.—*Verneuilina turris*, sp.n. Side views	70	203
Fig. 11.— ,, ,, ,, Apical view	70	
Fig. 12.— ,, ,, ,, Basal view	90	
Fig. 13.—*Gaudryina ferruginea*, sp.n. Balsam mount	105	200
Figs. 14, 15.— ,, ,, ,,	90	
Figs. 16, 17.—*Gaudryina rugosa*, d'Orbigny. Long type	62	197
Figs. 18, 19.—*Bulimina chapmani*, sp.n. Side views.	45	233
Fig. 20.— ,, ,, ,, Oral view	45	
Figs. 21, 22.—*Bolivina punctata*, var. *arenacea*, nov.	90	242
Figs. 23, 24, 25.—*Bifarina porrecta*, var. *arenacea*, nov..	70	240
Fig. 26.— ,, ,, ,, ,, Balsam mount	70	
Figs. 27, 28.—*Bolivina variabilis*, var. *arenacea*, nov.	90	646
Figs. 29, 30.—*Bolivina textilarioides*, var. *arenacea*, nov.	135	645
Figs. 31, 32.—*Bolivina inflata*, var. *arenacea*, nov.	135	254
Fig. 33.— ,, ,, ,, ,, Balsam mount	180	
Figs. 34, 35.—*Bolivina tortuosa*, var. *arenacea*, nov.	90	259
Figs. 36, 37, 38.—*Cassidulina subglobosa*, var. *tuberculata*, nov.	90	267


1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.
35.
36.
37.
38.

BRITISH MUSEUM
Z D
NATURAL HISTORY

PLATE V.

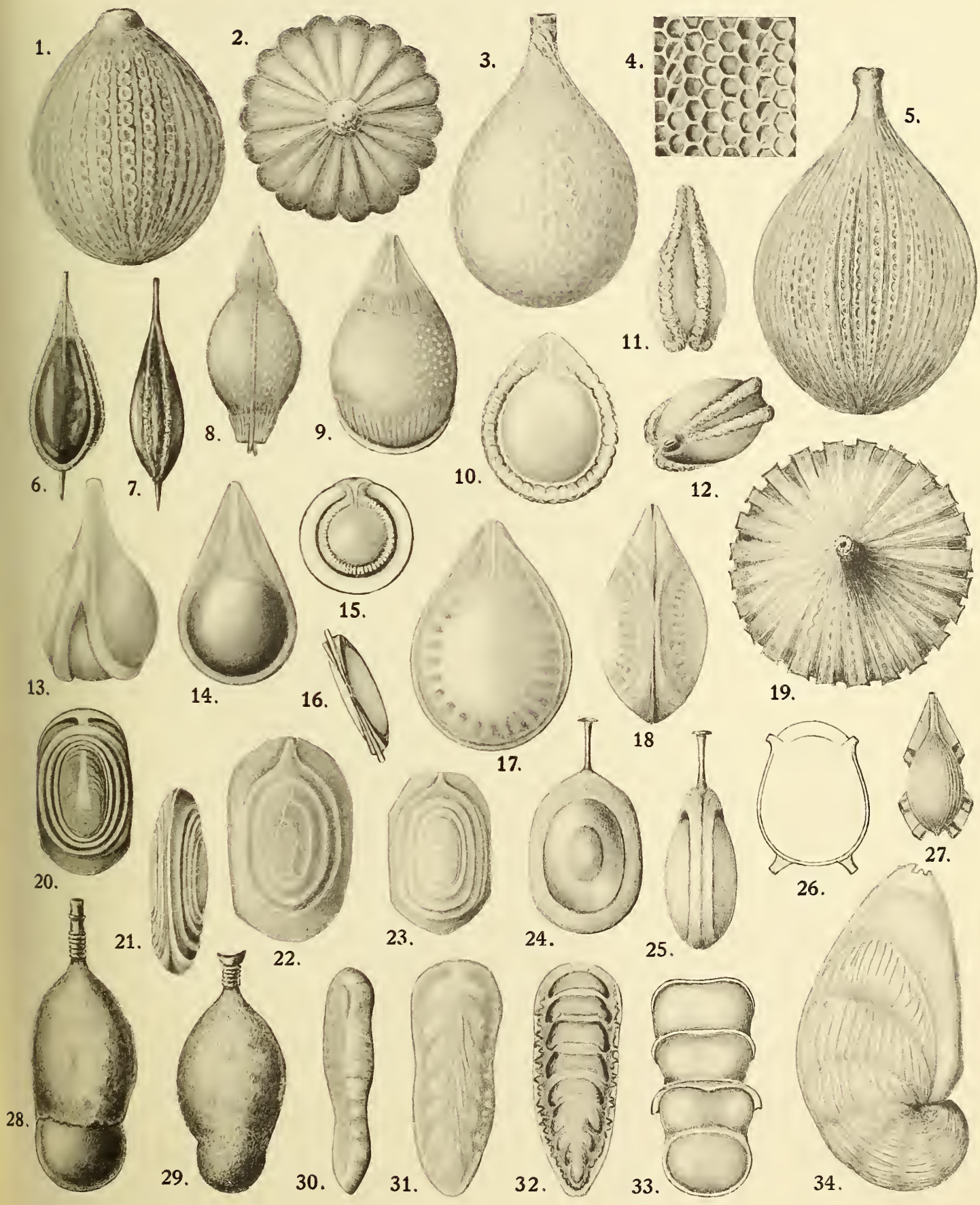
		Magn.	No.
Figs. 1, 4, 5.—*Ehrenbergina hystrix*, var. *glabra*, nov.	Oral side views	90	275
Figs. 2, 3.— „ „ „ „ „	Dorsal side views	90	
Fig. 6.— „ „ „ „ „	End view, oral	90	
Fig. 11.— „ „ „ „ „	Abnormal—double shell	75	
Fig. 7.—*Lagena clavulus*, sp.n.		135	292
Figs. 8, 9, 10.—*Cassidulina laevigata*, var. *tumida*, nov.		90	263
Figs. 12, 13, 14.—*Lagena globosa*, var. *lineato-punctata*, nov.		135	280
Fig. 15.—*Lagena squamoso-sulcata*, sp.n.		90	317
Fig. 19. „ „ „ „	Oral view	90	
Fig. 16.—*Lagena catenulata*, Reuss.	Oral view	180	319
Figs. 17, 18.—*Lagena catenulata*, Reuss.		180	
Figs. 20, 21, 22.—*Lagena stelligera*, var. *nelsoni*, nov.		140	306
Fig. 23.—*Lagena marginata* (Walker & Boys)	Serrate variety	230	338
Fig. 24.—*Lagena marginata* var. *fissa*, nov..		90	339
Fig. 25.— „ „ „ „	Edge view	90	


1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.

BRITISH MUSEUM
NATURAL HISTORY

PLATE VI.

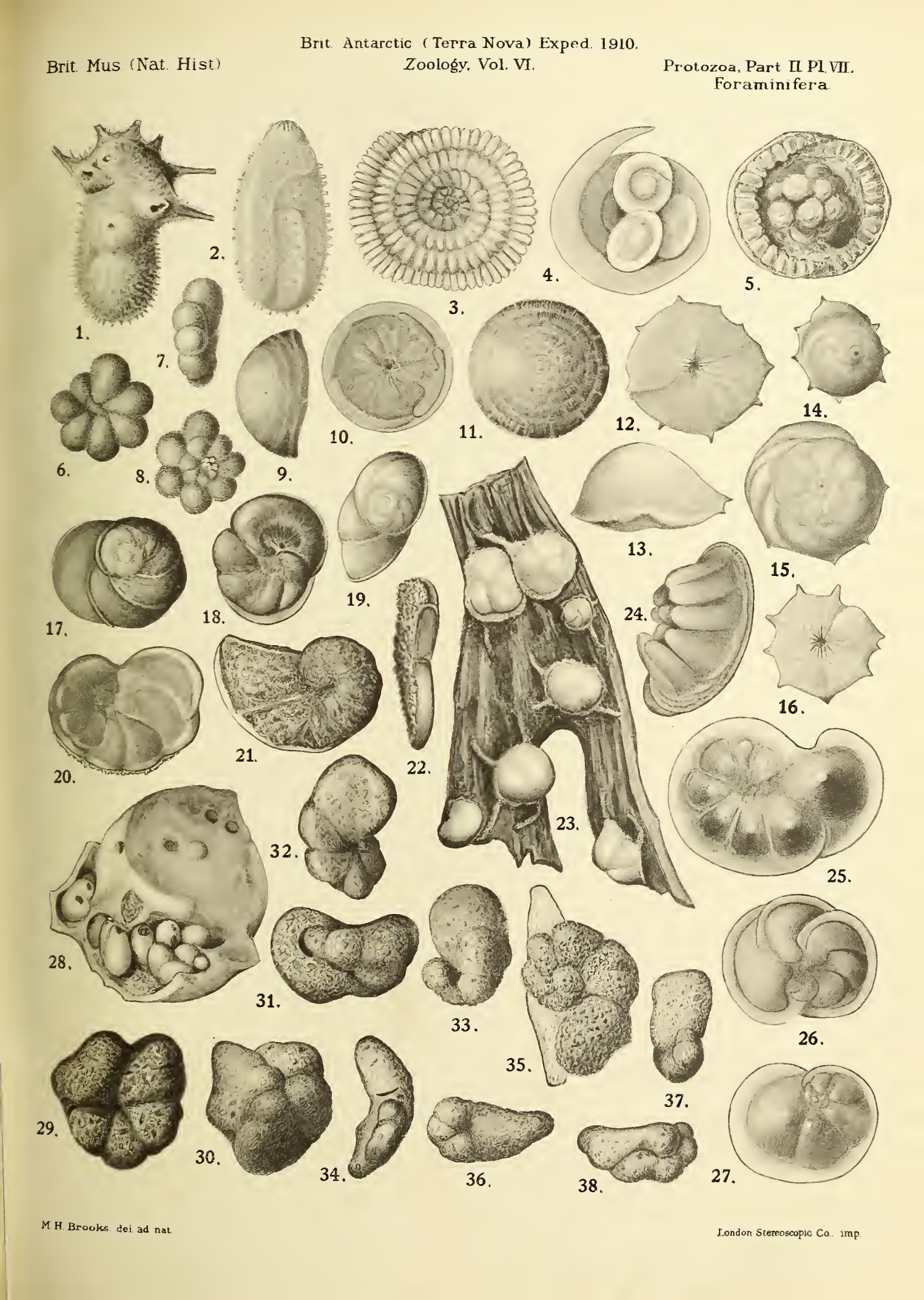
	Magn.	No.
Fig. 1.—*Lagena squamosa*, (Montagu)	135	316
Fig. 2.— ,, ,, ,, Oral view	135	
Fig. 3.—*Lagena scottii*, sp.n.	70	315
Fig. 4.— ,, ,, ,, Detail of surface-ornament	140	
Fig. 5.—*Lagena striatopunctata*, Parker & Jones	62	309
Figs. 6, 7.—See under Fig. 11.		
Fig. 19.— ,, ,, ,, Oral view	62	
Fig. 9.—*Lagena marginato-perforata*, Seguenza	140	344
Fig. 8.— ,, ,, ,, Edge view	140	
Figs. 10, 12.—*Lagena bicarinata*, var. *villosa*, nov.	160	357
Fig. 11.— ,, ,, ,, ,, Edge view	160	
Fig. 6.—*Lagena bicarinata*, var. *spinigera*, nov.	100	358
Fig. 7.— ,, ,, ,, ,, Edge view	100	
Fig. 14.—*Lagena danica*, var. *pendulum*, nov.	107	376
Fig. 13.— ,, ,, ,, ,, Edge view	107	
Fig. 15.—*Lagena orbignyana*, var. *baccata*, nov.	107	363
Fig. 16.— ,, ,, ,, ,, Oral edge view	107	
Fig. 17.—*Lagena orbignyana*, var. *yokoyamae*, Millett	135	367
Fig. 18.— ,, ,, ,, ,, ,, Edge view	135	
Fig. 19.—See under Fig. 5.		
Figs. 20, 22, 23.—*Lagena scarabaeus*, sp.n.	90	368
Fig. 21.— ,, ,, ,, Edge view	90	
Fig. 24.—*Lagena formosa*, Schwager	160	350
Fig. 25.— ,, ,, ,, Edge view	160	
Fig. 26.—*Lagena auriculata*, Brady. Variety. Balsam mount	180	379
Fig. 27.— ,, ,, var. *quadri-auriculata*, nov.	115	380
Fig. 29.—*Nodosaria pellita*, sp.n.	125	408
Fig. 28.— ,, ,, Initial chamber denuded of outer coating	125	
Fig. 31.—*Frondicularia scottii*, sp.n. Side view	45	415
Fig. 30.— ,, ,, Edge view	45	
Fig. 32.— ,, ,, Balsam mount	45	
Fig. 33.—*Frondicularia pygmaea*, Sidebottom	135	412
Fig. 34.—*Cristellaria costata* (Fichtel & Moll). Variety.	100	440


1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.

BRITISH MUSEUM
NATURAL HISTORY

PLATE VII.

	Magn.	No.
Fig. 1.—*Polymorphina sororia*, Reuss. Aculeate and fistulose variety	70	444
Fig. 2.— ,, *oblonga*, Williamson. Aculeate variety	62	442
Fig. 3.—*Spirillina selseyensis*, Heron-Allen and Earland	160	505
Fig. 4.— ,, *vivipara*, Ehrenberg. Parent shell with young brood	250	493
Fig. 5.—*Patellina corrugata*, Williamson. ,, ,, ,, ,,	125	506
Fig. 6.—*Globigerina cretacea*, var. *eggeri*. Inferior view	90	476
Fig. 7.— ,, ,, ,, ,, Edge view.	90	
Fig. 8.— ,, ,, ,, ,, Superior view	90	
Fig. 9.—*Discorbina harmeri*, sp.n. Edge view	90	539
Fig. 10.— ,, ,, ,, Inferior view	90	
Fig. 11.— ,, ,, ,, Superior view	90	
Figs. 12, 16.—*Discorbina calcarata*, sp.n. Inferior views	107	538
Fig. 13.— ,, ,, ,, Edge view	107	
Figs. 14, 15.— ,, ,, ,, Superior views	107	
Fig. 17.—*Discorbina wilsoni*, sp.n. Superior view	90	543
Fig. 18.— ,, ,, ,, Inferior view	90	
Fig. 19.— ,, ,, ,, (Superior) edge view	90	
Fig. 20.—*Discorbina disparilis* sp.n. Inferior view	90	541
Fig. 21.— ,, ,, ,, Superior view	90	
Fig. 22.— ,, ,, ,, Edge (oral) view	90	
Fig. 23.—*Truncatulina refulgens* (Montfort). Sessile specimens with arenaceous tubular processes	13	549
Fig. 28.— ,, ,, ,, Parent shell with young brood in chambers	62	
Fig. 24.—*Truncatulina tenuimargo*, var. *alto-camerata*, nov. (Superior) edge view	62	554
Figs. 25, 27.— ,, ,, ,, ,, ,, Superior view	62	
Fig. 26.— ,, ,, ,, ,, ,, Inferior view	62	
Fig. 28.—See under Fig. 23.		
Fig. 29.—*Rotalia soldanii*, var. *arenacea*, nov. Superior view	80	601
Fig. 30.— ,, ,, ,, ,, ,, Inferior view	80	
Fig. 31.— ,, ,, ,, ,, ,, Edge (oral) view	80	
Fig. 32.—*Truncatulina lobatula*, var. *arenacea*, nov. Free, inferior view.	90	551
Fig. 33.— ,, ,, ,, ,, ,, Free, superior view	90	
Fig. 34.— ,, ,, ,, ,, ,, Free, edge (oral) view	90	
Fig. 35.— ,, ,, ,, ,, ,, Sessile.	90	
Figs. 36, 38.—*Nonionina turgida*, var. *arenacea*, nov. Side views	110	619
Fig. 37.— ,, ,, ,, ,, Oral view	110	


1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.
35.
36.
37.
38.

BRITISH MUSEUM
Z D
NATURAL HISTORY

PLATE VIII.

Polytrema miniaceum (Linné). No. 608.

Note.—Figures 7, 24, and 29 were drawn from Corsican specimens.

Fig. 1.—Earliest observed stage, lying on sponge but apparently not attached.

Figs. 2, 3.—Very early stages of the free form.

Figs. 4, 5, 6, 7.—Development of the free form into the " raspberry " stage. Fig. 7 marks the ultimate possible development, and was not observed in the New Zealand material.

Fig. 8.—The free " raspberry " form becomes sessile. At this early stage the pavement layer of chambers by which it attaches itself is not visible from above.

Fig. 9.—A specimen similar to Fig. 8, detached to show the ruptured pavement layer of chambers.

Fig. 13.—A partial section through a specimen slightly more advanced than Fig. 9, showing the " raspberry " in a nest of pavement chambers which are commencing to form outgrowths.

Fig. 10.—A more advanced specimen which has been attached to the rounded stem of a Zoophyte. The pavement layer and its outgrowths have entirely enveloped the " raspberry," forming two tubular outgrowths, and are spreading round the stem of the host.

Figs. 11, 12, 14.—Stages in the development of the pavement and investing layer of chambers, and the formation of tubular apertures.

Figs. 15, 16, 17.—Further stages of development involving the final disappearance of the " raspberry " in the investing layers.

Figs. 18, 19, 21, 22.—Transition stages up to the adult.

Fig. 20.—Section through primordial chambers of the free " raspberry " stage.

Fig. 23.—An adult specimen attacked by an organism which has tunnelled into the hard test.

Fig. 24.—A similar specimen (from Corsica) in which the ravages of the boring organism have exposed the " raspberry," which, owing to its thicker test, has been left untouched.

Fig. 25.—Adult stage, section showing concentric layers of investing chambers in trunk.

Fig. 26.—Detail of surface-layer from Fig. 25, showing the reticulate character of each investing layer of chambers. The round pits are the first stage in the formation of " pillar pores."

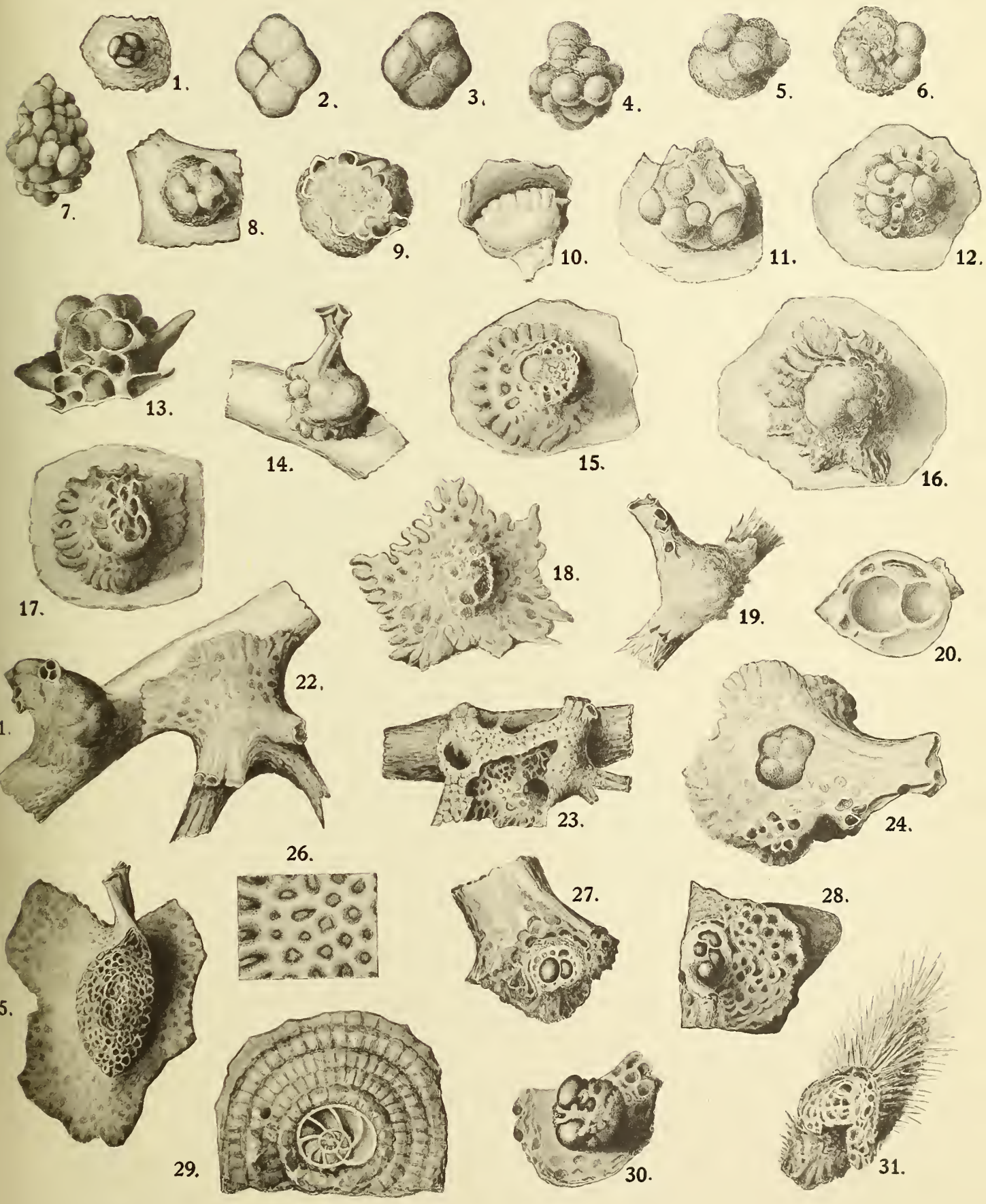
Figs. 27, 28.—Partially decalcified basal portions in which the position and structure of the " raspberry " are clearly shown. The thick chitinous linings of the chambers of the raspberry have resisted the process of decalcification.

Fig. 29.—Basal view of a part of the base of a microspheric specimen, showing rotaline initial chambers.

Fig. 30.—A partially decalcified specimen viewed from the base and showing the chitinous lining of the pavement layer of chambers which had attached the " raspberry " to its host.

Fig. 31.—A fragment of *Polytrema* with envelopment of large sponge-spicules, perhaps due to symbiosis of the two organisms.

Magnifications—Figs. 1, 2, 3, × 50.
,, 4 to 14, 24, × 40.
,, 15 to 19, 26 to 28, × 30.
,, 20 and 30, × 60.
,, 21 to 23, 25, × 15.
,, 29, × 90.
,, 31, × 25.


1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.
19.
20.
21.
22.
23.
24.
26.
25.
27.
28.
29.
30.
31.

BRITISH MUSEUM
Z D
NATURAL HISTORY

BRITISH MUSEUM (NATURAL HISTORY).

BRITISH ANTARCTIC ("TERRA NOVA") EXPEDITION, 1910.

NATURAL HISTORY REPORT.

ZOOLOGY. VOL. VI. No. 3 Pp. 269-392.

PORIFERA.

PART I.—NON-ANTARCTIC SPONGES,

BY

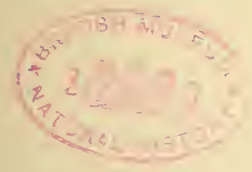
ARTHUR DENDY, D.Sc., F.R.S.,
Late Fellow of King's College, and Professor of Zoology in the University of London.

FIVE FITTED PLATES

LONDON:
PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM.
[illegible]
1921
[illegible]
Price Seventeen Shillings and Sixpence.

British Museum (Natural History).

This is No. 3. *of* 25 *copies of "Terra Nova" Zoology, Vol. VI., Porifera, Part I., printed on Special paper.*



PORIFERA.

PART I.—NON-ANTARCTIC SPONGES.

BY ARTHUR DENDY, D.Sc., F.R.S.

(Fellow of King's College and Professor of Zoology in the University of London).

WITH FIFTEEN PLATES.

PAGE

I.—Introduction 269
II.—General Notes 270
III.—List of Species 273
IV.—Description of Species 275
V.—List of Literature referred to 385
VI.—Index 388

I.—INTRODUCTION.

It was originally arranged, in 1914, that my late colleague, Mr. R. W. Harold Row, B.Sc., should co-operate with me in the production of this Report. The outbreak of the European War, however, made it necessary for both of us to turn our attention largely or entirely to other work, and Mr. Row's untimely death, in February 1919, ended all hope of a joint resumption of the task. As it was, he was able to do little more than assist in the preliminary sorting out of the collection and took no share in writing the Report itself. Into the preliminary work he threw himself with his customary ardour, interesting himself especially in searching for the small encrusting sponges which form such an interesting part of the collection, some of which might well have escaped observation but for his enthusiasm. Almost from the beginning, however, I have been obliged to carry on the work single-handed, save for the valuable help of my skilled laboratory assistant, Mr. Charles Biddolph, who has done most of the section-cutting and photography, of Mr. T. P. Collings, who has drawn many of the external forms, and of Miss Hilda Deakin, who is responsible for the best of the spicule drawings. I have to express my gratitude to all these for their excellent work, and to the Trustees of the British Museum for financial assistance in this connexion.

II.—GENERAL NOTES.

The "Terra Nova" collection of sponges was divided by the authorities of the Natural History Department of the British Museum into two parts, Antarctic and non-Antarctic, and it is the latter that form the subject of this Report. As a matter of fact, nearly all the non-Antarctic specimens came from the north of New Zealand, the only exceptions being *Chondrilla nucula* from South Trinidad, *Halichondria magellanica* from east of the Straits of Magellan, and *Mycale magellanica* and *Mycale lilliei* from north of Cape Horn.

In these introductory remarks I shall confine myself exclusively to the New Zealand species. These number no less than eighty-eight, of which sixty have had to be described as new. Of the remaining twenty-eight, twenty-four have been definitely assigned to previously known species, while four have been more or less doubtfully identified. It will thus be seen that the percentage of new species is extremely high, but the remarkable character of the collection is even more strongly emphasised by the fact that it has seemed desirable to propose no less than nine new genera, most of which are of great intrinsic interest.

We are thus presented with a very large and important addition to our knowledge of the New Zealand marine fauna, and that in a group which has hitherto been very much neglected so far as New Zealand is concerned. Perhaps the most remarkable thing about this addition is that it was made in such a short time and over such a very limited area. It appears from the list of collecting stations that the "Terra Nova" was cruising off the north of New Zealand from July 16th to September 24th, 1911. Most of that time, however, seems to have been occupied in plankton work, and dredging or trawling was carried on only at six stations, viz. 90, 91, 95, 96, 134, 144. Sponges were obtained from all of these with the curious exception of 95, but this exception is probably apparent only and due to incomplete labelling, for there are two sponges in the collection from "Off North Cape, Sandy Bottom, 30–14 fathoms, August 2nd, 1911," which, if not actually Station 95, must be very close to it. There are also a few other cases in which a locality is given without a station number.

Station 90, near the Three Kings Islands, at a depth of 100 fathoms, with a rocky bottom, yielded the most remarkable results, viz. thirty-eight species of sponges, of which twenty-seven were new, belonging to twenty-eight genera of which six were new. Station 96, seven miles east of North Cape, at a depth of 70 fathoms, with bottom sand and rock, proved almost equally rich, with twenty-six species (twenty-one new) belonging to twenty-one genera (two new), to which should doubtless be added two more new species from the same locality but without station number attached.

These two cases give a good idea of the astonishing richness of the sponge

fauna of these waters and of the great variety of genera and species. There are never many specimens of the same species in the collection, they are nearly all different, and seem to have grown together with little, if any, segregation. This mixture of species in the same area seems to be characteristic of sponges generally, for I have had just the same experience in dredging in Australian waters.

There is another feature of the "Terra Nova" collection that strikes one at once, and that is the abundance of species exhibiting a very definite and remarkable external form, often of large size. Amongst these may be mentioned *Symplectella rowi*, a new genus and species of Hexactinellida, of large size and very beautiful form; a number of large Stellettids, mostly new; two beautiful, new, cup-shaped Geodias, one (*Geodia rex*) of very large size and with a crust of sterrasters so large as to be individually visible to the naked eye; a beautiful new Lithistid (*Aciculites pulchra*); an extraordinary double-fan-shaped *Gellius* (*G. imperialis*, n. sp.); a very curious, large, trumpet-shaped *Siphonochalina* (*S. latituba*, n. sp.); a fine tubular *Isodictya* (*I. cavicornuta*, n. sp.); two handsome Clathrias; two Raspailias; a very fine and well-characterised *Tedania*, and a very interesting species of a new genus (*Tedaniopsis turbinata*), which not only has a striking external form but seems to undergo a metamorphosis between the young fixed stage and the adult condition. The curious bladder-like Cœlosphæreæ are represented by new species of the remarkable and little-known genera *Pyloderma*, *Inflatella*, *Amphiastrella* and *Histodermella*.

There are only six species of calcareous sponges, but three of these are new and striking. Doubtless many more would have been obtained in shallower water. Much more remarkable is the small number of true horny sponges (Euceratosa), only three species having been obtained; and there are no representatives of the family Spongiidæ, to which the bath-sponge belongs.

One more feature of the collection remains to be noticed, and that is the encrusting sponges. These are usually much neglected by collectors, as they are small and inconspicuous, but they well repay the trouble of searching for them, since they include some of the most remarkable sponges known, especially as regards spiculation. A small block of black basalt, measuring about $6 \times 4 \times 2$ inches, from Station 90, furnished no less than ten species of encrusting sponges, including six new species and two new genera. Of these, *Lepidospongia incrustans*, n. gen. et sp., is an extraordinarily aberrant Lithistid, with the spiculation almost entirely reduced to a thin crust of scales; *Dotonella mirabilis*, n. gen. et sp., is a form with wonderful spirulæ resembling those of *Dotona*; *Esperiopsis macrosigma*, Stephens var., *novæ-zealandiæ*, nov., and *Esperiopsis megachela* are remarkable for their large and very beautiful chelæ. Unfortunately the block, with its rich growth of sponges, was dried.

A small pebble from the same station was encrusted by *Discorhabdella incrustans*, n. gen. et sp., one of the gems of the collection, with a most curiously reduced and modified acanthotylostyle, a type of spicule previously known only in the fossil state, from the early tertiary deposits of siliceous earth at Oamaru in the

South Island of New Zealand, and exhibiting a slightly more advanced stage in reduction as compared with the fossil form.

Had more stones been examined and preserved there can be little doubt that many more encrusting sponges would have been obtained.

Another encrusting species—*Desmacella vestibularis*—occurs frequently on the surface of several species of Stellettidæ, sometimes almost, if not quite completely, covering them, and the question arises whether or not we may have here a true case of commensalism.

It will be seen from the figures given above that 71·4 per cent. of the identifiable species have had to be regarded as new. This indicates a high degree of peculiarity for the New Zealand sponge fauna, but perhaps not higher than might be expected when we consider the isolated position of the area in question. There is, however, an evident relationship with the Australian sponge fauna, as indicated by the following species known only from Australia and New Zealand—*Leucosolenia stolonifer*, *Grantessa poculum*, *Pachychalina aurantiaca*, *Siphonochalina stellidermata*, *Chalinopsilla palmata*, *Megalopastas elegans* and *Spongelia hirciniformis*. *Phoriospongia kirkii* is also a well-known Australian species, but extends as far as India, and the Australian affinity is further strengthened by the occurrence of the well-characterised genus *Trachycladus*, represented by a species closely related to the common Australian one. There is a suggestion of an Antarctic affinity in the presence of a variety of *Guitarra antarctica* and of the genus *Tedaniopsis*, but in the present state of our knowledge of sponge distribution it would hardly be safe to go beyond this.

The preservation of the specimens left much to be desired, but that could hardly have been otherwise under the circumstances. It was evidently found impossible to find jars enough to contain such a large amount of material, especially as many of the specimens were of large size. Consequently we found a good deal of overcrowding. A large number of specimens had been placed in spirit in a copper tank, with the result that they were stained a deep green colour. Others had been dried. In some cases the contents of an entire jar appeared to have been treated with osmic acid, so that they were almost black, and their histological condition was not improved. Osmic acid should only be employed with the usual precautions on small pieces selected for the purpose, but this is a laborious business which can hardly be undertaken profitably where large masses of material have to be dealt with rapidly. The best general preservative is good methylated spirit, changed at least once, and overcrowding should be carefully avoided. Formalin, according to my experience, is worse than useless in most cases, and it would be better to dry the specimens. Indeed, if small pieces are cut off, carefully labelled, and preserved in strong spirit, there is no reason why drying should not be generally adopted for large specimens.

The classification adopted is that which I have employed in previous papers,

especially those dealing with the sponges of the "Sealark" Expedition. Generic diagnoses are given only in the case of new genera and of those that I have not previously had occasion to make use of. I have also followed my usual system of registering the individual specimens. R. N. stands for Register Number. The Roman numerals are the numbers of the jars or other receptacles in which the sponges reached us; Arabic numerals (and sometimes letters) are used to denote different specimens in cases where there were more than one in a receptacle. It is thus possible not only to refer to individual specimens in the text but also to trace them back to their original associations, which may be a matter of some importance in cases of the occurrence of foreign spicules or accidental post-mortem staining.

III.—LIST OF SPECIES.*

Order CALCAREA.

Family HOMOCŒLIDÆ.

1. *Leucosolenia stolonifer*, Dendy.

Family LEUCALTIDÆ.

2. *Leucettusa tubulosa*, n. sp.
3. „ *lancifer*, n. sp.

Family HETEROPIIDÆ.

4. *Grantessa poculum* (Poléjæff).

Family GRANTIIDÆ.

5. *Grantia ramulosa*, n. sp.
6. *Ute syconoides* (Carter)?

Order HEXACTINELLIDA.

Family ROSSELLIDÆ.

7. *Rossella ijimai*, n. sp.
8. *Symplectella rowi*, n. gen. et sp.

Order TETRAXONIDA.

Sub-order ASTROTETRAXONIDA.

Family STELLETTIDÆ.

9. *Stelletta maori*, n. sp.
9ª. „ „ var. *bistellata*, nov.
10. „ *crater*, n. sp.
11. „ *columna*, n. sp.
12. *Ancorina progressa*, Lendenfeld, var. *diplococcus*, nov.
13. *Ancorina stalagmoides*, n. sp.
14. „ *alata*, n. sp.
15. „ *osculifera*, n. sp.
16. „ *novæ-zealandiæ*, n. sp.
17. *Penares tylotaster*, n. sp.
18. *Jaspis novæ-zealandiæ*, n. sp.
19. *Asteropus simplex* (Carter).
20. *Spongosorites novæ-zealandiæ*, n. sp.

Family GEODIIDÆ.

21. *Geodia regina*, n. sp.
22. „ *rex*, n. sp.
23. *Geodinella vestigifera*, n. sp.

Family CHONDROSIIDÆ.

(24. *Chondrilla nucula*, Schmidt.)

Sub-order SIGMATOTETRAXONIDA.

Family LITHISTIDÆ.

25. *Aciculites pulchra*, n. sp.
26. *Lepidospongia incrustans*, n. gen. et sp.

Family TETILLIDÆ.

27. *Craniella zetlandica* (Carter).
28. *Cinachyra uteoides*, n. sp.

* In this classified list the names of species not coming from New Zealand are enclosed in brackets.

FAMILY HAPLOSCLERIDÆ.

SUB-FAMILY GELLIINÆ.

29. *Gellius flagellifer*, Ridley and Dendy.
30. *Gellius petrocalyx*, n. sp.
31. „ *imperialis*, n. sp.
32. „ *tubulo ramosus*, n. sp.

SUB-FAMILY RENIERINÆ.

33. *Petrosia coralloides*, n. sp.
(34. *Halichondria magellanica*, n.sp.)

SUB-FAMILY CHALININÆ.

35. *Chalina oculata* Bk. var. *novæ-zealandiæ*, nov.
36. *Pachychalina aurantiaca* (Lendenfeld).
37. *Ceraochalina pergamentacea* (Ridley).
38. *Siphonochalina communis* (Carter).
39. „ *minor*, Dendy, var. *regalis*, nov.
40. *Siphonochalina latituba*, n. sp.
41. „ *stellidermata* (Carter).
42. *Chalinopsilla palmata* (Carter).

SUB-FAMILY PHLŒODICTYINÆ.

43. *Oceanapia* (?) *arcifera*, n. sp.
44. *Phlœodictyon fistulosum* (Bk.) ?
45. „ *aberrans*, n. sp.

FAMILY DESMACIDONIDÆ.

SUB-FAMILY ESPERELLINÆ.

SECTION *Isodictyeæ*.

46. *Isodictya cavicornuta*, n. sp.

SECTION *Guitarreæ*.

47. *Guitarra antarctica*, Hentschel, var. *novæ-zealandiæ*, nov.

SECTION *Mycaleæ*.

(48. *Mycale magellanica* (Ridley).)
(49. „ *lilliei*, n. sp.)
50. *Mycale novæ-zealandiæ*, n. sp.
51. *Esperiopsis edwardii* (Bk.).
52. „ *macrosigma*, Stephens, var. *novæ-zealandiæ*, nov.
53. *Esperiopsis megachela*, n. sp.
54. *Artemisina jovis*, n. sp.
55. „ *elegantula*, n. sp.
56. *Desmacella vestibularis* (Wilson).
57. *Biemna novæ-zealandiæ*, n. sp.
58. „ sp.

SUB-FAMILY ECTYONINÆ.

SECTION *Iophoneæ*.

59. *Iophon lævistylus*, n. sp.
60. *Iophonopsis* sp., n. gen.

SECTION *Clathrieæ*.

61. *Bubaris oxeata*, n. sp.
62. „ *elegans*, n. sp.
63. „ *ornata*, n. sp.
64. „ *vermiculata* (Bk.).
65. *Clathria scotti*, n. sp.
66. „ *terræ-novæ*, n. sp.
67. *Raspailia topsenti*, n. sp.
68. „ *inæqualis*, n. sp.
69. *Rhabderemia coralloides*, n. sp.

SECTION *Hymedesmieæ*.

70. *Hymedesmia lundbecki*, n. sp.

SECTION *Myxilleæ*.

71. *Anchinoë fristedti*, n. sp.
72. „ *novæ-zealandiæ*, n. sp.
73. *Myxilla novæ-zealandiæ*, n. sp.
74. *Phoriospongia kirkii* (Carter).

SECTION *Crelleæ*.

75. *Crellomyxilla intermedia*, n. gen. et sp.

SECTION *Tedanieæ*.

76. *Tedania crista-galli*, n. sp.
77. *Tedaniopsis turbinata*, n. gen. et sp.

SECTION *Cœlosphæreæ*.

78. *Pyloderma demonstrans*, n. sp.

79. *Amphiastrella kirkpatricki*, n. sp.
80. *Inflatella spherica*, n. sp.
81. *Histodermella australis*, n. sp.

Sub-family AXINELLINÆ.
Section *Heteroxyeæ*.

82. *Parahigginsia phakellioides*, n. gen. et sp.

Family CLAVULIDÆ.
Sub-family SPIRASTRELLINÆ.

83. *Discorhabdella incrustans*, n. gen. et sp.
84. *Trachycladus stylifer*, n. sp.
85. *Dotonella mirabilis*, n. gen. et sp.

Sub-family SUBERITINÆ.

86. *Suberites carnosus* (Johnston), var. *novæ-zealandiæ*, nov.
87. *Polymastia conigera*, Bowerbank.
88. *Microtylostylifer anomalus*, n. gen. et sp.

Order EUCERATOSA.

Family DARWINELLIDÆ.

89. *Megalopastas elegans* (Lendenfeld).

Family SPONGELIIDÆ.

90. *Spongelia hirciniformis* (Carter).
91. ,, *spiculivora*, n. sp.

IV.—DESCRIPTION OF SPECIES.

Order CALCAREA.

Family HOMOCŒLIDÆ.

1. *Leucosolenia stolonifer*, Dendy [1891].

There is a single colony of this sponge in the collection, consisting of three tubular "persons" united basally by a tubular spongorhiza, of which, however, only a fragment remains. The external appearance is perfectly typical and agrees closely with the figure given by me in 1891. The agreement in anatomical features is also very close. In fact the only differences as compared with typical Victorian specimens concern certain details of spiculation. The apices of the facial rays of the quadriradiates are blunted instead of being sharply pointed. The large oxea are much more slender in their proximal portions, while the inner extremity is more or less sharply bent to one side; the apices again seem to be bluntly rather than sharply pointed, but as the outer end of the spicule is almost invariably broken off it is necessary to speak with some reserve on this point.

The most characteristic feature of this species is unquestionably afforded by the fact that some of the quadriradiate spicules develop enormous crooked apical rays projecting into the gastral cavity. These are very numerous and very strongly developed in the "Terra Nova" specimens. As in the type, all the radiates seem to have apical rays, either large or small.

Previously known Distribution.—Near Port Phillip Heads, Victoria (Dendy).

Register No., Locality, &c.—XLVII. 2; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

Family LEUCALTIDÆ.

2. *Leucettusa tubulosa*, n. sp. (Pl. I, figs. 1–10.)

There are several specimens of this sponge in the collection. The external appearance of the best two is well represented in figs. 1, 2. Each of these consists of a group of three tubular branches, separating from one another close to the base of attachment and each having a single terminal vent. The form of the branches, or "persons," as they may perhaps be considered to be, differs somewhat in the two specimens. In R. N. XIX. 3 (fig. 2) they are approximately straight and nearly cylindrical, enlarging but very slightly towards the free end, which contracts somewhat suddenly to the circular vent. The longest, from which the other two come off as branches, measures about 50 mm. in height, with a maximum diameter of about 7 mm. In R. N. XIX. 2 (fig. 1) they are much more club-shaped and rather strongly curved, and the vent has more the form of a slit. The largest measures about 60 mm. in height, with a maximum diameter of about 17 mm.

The outer surface is smooth, but the large tangential radiates of the dermal cortex are clearly visible under a pocket lens. The vents have thin margins, but there is no distinct collar and no spicular fringe. The colour of the specimens was probably white in life, but they have been stained black with osmic acid.

The wall of the tubular "persons" is about 1·5 to 2 mm. thick and the wide central cavity is continued practically to the base, without interruption by trabecular ingrowths. Hence there is a well-defined gastral surface, perforated by the numerous apertures of the exhalant lacunæ. The differentiation of the sponge wall into cortical and medullary layers is well marked, but the latter is very much thicker than the former, in the ratio of about 7 to 1.

The medullary portion is almost co-extensive with the chamber-layer, there being only a thin gastral membrane around the central cavity. The dermal cortex consists of a gelatinous collenchyma in which the large radiates are embedded. It contains numerous large granular cells, most of which are evidently the contracted epithelial cells of the inhalant channels.

The canal system is typically leuconoid, the flagellate chambers, thickly scattered in the chamber-layer, being sub-spherical and about 0·1 mm. in diameter. The thickly scattered dermal pores lead, through irregular canals in the cortex, into the large, radially disposed, inhalant lacunæ, which interdigitate with similar exhalant lacunæ opening on the gastral surface.

Although the material has been treated with osmic acid its histological condition is very poor, and we have been unable to make out the position of the nucleus in the collared cells, which are completely contracted into spherical vacuolated bodies, mostly separated from the walls of the chambers.

The skeleton is chiefly developed in the dermal cortex, which is crowded with large triradiate and quadriradiate spicules disposed tangentially in several layers.

These spicules vary greatly in size, the smaller ones being for the most part on the outer side. The larger ones are nearly all quadriradiate, and the large apical ray projects at right angles into, and it may be nearly through, the chamber layer. Around the margin of the vent the ordinary dermal cortical skeleton gives place to a dense feltwork of sagittal triradiates, orientated in the usual way, with the paired rays parallel to the oscular margin. The chamber layer contains a few large, scattered radiates, but has no other spicules which can properly be said to belong to it, unless it be a few of the reduced pigmy radiates, but most of the pigmy radiates belong to the walls of the central gastral cavity and of the exhalant lacunæ, which are echinated by their projecting rays.

Spicules:—(1) Large triradiates (fig. 4); regular; rays long, stout or slender, conical or nearly cylindrical, often irregular in outline, especially towards the apex, which is usually rather bluntly pointed; measuring up to about 0·79 by 0·062 mm., but very variable.

(2) Large quadriradiates (fig. 3); similar to the regular triradiates, but attaining a somewhat larger size, and with a strongly developed, long, straight, stout apical ray, which may be more than 0·776 mm. in length.

(3) Sagittal triradiates (fig. 9); with the oral or paired rays variously bent, sometimes extended in a straight line with one another, sometimes with the distal portion bent backwards or forwards, but apparently always with the proximal portions of the three rays meeting at angles of 120°. These spicules vary a good deal in size, but are, on an average, very distinctly smaller than the large regular triradiates. They are found, as already stated, at the margin of the vent.

(4) Pigmy triradiates (figs. 8, 10); varying from regular to sagittal, but apparently always equiangular; rays ranging from slender and sharply pointed to stout and very strongly club-shaped; size variable, say about 0·035 by 0·005 mm. (length and diameter of ray).

(5) Pigmy quadriradiates (fig. 6); similar to the pigmy triradiates, but with an apical ray which may be enormously developed, especially in the lining of the gastral cavity, where they are very abundant in the neighbourhood of the vent. Two very characteristic specimens, with club-shaped facial and enormous apical rays, are shown in fig. 6. In one of these the apical ray measures as much as 0·2 by 0·0075 mm., while the facial rays measure only about 0·03 by 0·0075 mm.

The pigmy radiates often show a strong tendency for the rays to separate from one another at the centre of the spicule (cf. fig. 7), especially in the case of the apical rays of the quadriradiates. I do not think that this can be due to the action of the osmic acid used in preserving the sponge, for the spicules show little, if any, sign of erosion.

(6) Reduced pigmy radiates with only two rays (fig. 5); much smaller than the ordinary pigmy radiates and sparsely scattered in the tissues of the medullary layer. The two remaining rays are somewhat fusiform and sharply pointed, measuring each

about 0·0125 by 0·0025 mm. The third ray seems to be represented by a minute knob.

This species is certainly nearly related to *Leucettusa imperfecta* (Poléjæff) from near Port Jackson. It agrees with that species in external form and general anatomy, and in the presence of large quadriradiates, but it differs much in the characters of the pigmy radiates. The highly characteristic gastric quadriradiates with club-shaped facial rays and enormously developed apical rays appear, to judge from Poléjæff's description [1883], to be entirely wanting in *Leucettusa imperfecta*, and the reduced pigmy radiates with only two rays are also quite different.

The tendency of the rays of the pigmy radiates to be swollen out at the extremities into a club-like form, which is such a characteristic feature of our species, is also seen in *Leucettusa corticata* (Hæckel), but that species differs widely from ours in external form, which is that of a reticulate colony, and in the entire absence of quadriradiates.

Register Nos., Localities, &c.—XIX. 2, 3; LV. 1. *b* (attached to surface of *Tedaniopsis turbinata*, LV. 1. *c*), all from Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

3. *Leucettusa lancifer*, n. sp. (Pl. I, figs. 11–18.)

This species is represented in the collection by two specimens, each consisting of an oval body tapering below into a longish cylindrical stalk and bearing a single prominent vent above. The body is more or less filled with gelatinous tissue and the thin wall in both specimens, but especially in R. N. XIV. 2 (fig. 17), is partially collapsed by shrinkage. The stalk is also cored by the gelatinous medullary tissue, but is firmer and more rigid. In R. N. XIV. 2 the stalk is attached below to a pebble, in R. N. XLIII (fig. 16) it is broken off short. The single apical vent is situated on a slight elevation and surrounded by a thin margin; in R. N. XIV. 2 it is somewhat eccentric in position, in both specimens it measures only some 4 or 5 mm. in maximum diameter. The surface of the sponge is smooth, but the large tangential triradiates of the dermal cortex are very distinctly visible under a pocket lens. R. N. XIV. 2 measures about 50 mm. in total height; the maximum diameter of the swollen body is 21 mm., while the diameter in the middle of the stalk is only 5 mm. R. N. XLIII is rather smaller. The colour of R. N. XLIII, in spirit, is white; R. N. XIV. 2 has been stained black with osmic acid.

The dermal cortex in the body of the sponge is about 0·63 mm. thick; the medullary portion of the sponge wall extends into the central gastral cavity as an irregular network of trabeculæ, so that there is no properly defined gastral surface. The flagellate chambers, which are thickly crowded in the outer portion of the medulla, are only very sparingly scattered in the central network, which is composed principally of gelatinous mesoglœa and flattened epithelium. The gelatinous mesoglœa is also very strongly developed in the dermal cortex.

Except for the partial blocking up of the central gastral cavity as above described, the canal system resembles that of *Leucettusa tubulosa*, being typically leuconoid, with subspherical or oval flagellate chambers about 0·14 mm. in diameter. The collared cells are completely rounded off and the position of the nuclei cannot be determined satisfactorily in our preparations.

The skeleton is almost confined to the dermal cortex, which is crowded with large triradiates, arranged tangentially in several layers. The medullary portion of the sponge contains nothing but pigmy radiates, scattered in the walls of the exhalant lacunæ; very numerous in some places, but almost or quite absent in others. Large quadriradiates appear to be entirely lacking. Around the margin of the vent, where this happens to be intact, there is a narrow zone of sagittal triradiates of smaller average size than the ordinary cortical triradiates, arranged in the usual manner, with the paired rays parallel to the oscular margin, although occasionally this arrangement seems to be reversed.

Spicules:—(1) Large triradiates (fig. 13); regular, with long and rather slender rays, almost cylindrical for the greater part of their length, but gradually and fairly sharply pointed. Size very variable, the rays measuring up to about 1·0 by 0·062 mm.

(2) Sagittal triradiates. Owing to injury to the oscular margin these spicules have been observed only in one place (in R. N. XIV. 2). They closely resemble the corresponding spicules in *Leucettusa tubulosa*, the paired rays being usually bent back so as to lie almost in the same straight line, but sometimes bent forward, while all three rays meet in the middle at angles of 120°.

(3) Pigmy triradiates (figs. 12, 15); usually, if not always, more or less sagittal, but equiangular, the sagittal character being due to differentiation in shape or size, or both, between the basal and paired rays. The basal ray may be longer than the orals and is usually sharply bent near its apex. The rays are usually nearly cylindrical for the greater part of their length, but the orals may be slightly club-shaped; they always seem, however, to be fairly sharply pointed. The oral rays commonly measure about 0·04 by 0·0055 mm., with the basal only a little longer.

(4) Pigmy quadriradiates; some of these differ from the pigmy triradiates only in the addition of a comparatively small apical ray (fig. 18), but the typical form is very peculiar and characteristic (fig. 11). The basal ray is considerably longer than the orals, more or less crooked and rather sharply bent inwards from the gastral membrane in which the spicule lies. The oral rays curve towards one another like a pair of horns, so as to assume together a crescentic form, and their tips tend to curve outwards from the gastral membrane. All three facial rays are fairly gradually and sharply pointed. The apical ray is enormously developed; very straight and smooth in outline, gradually and sharply pointed. It may be more than four times the length of the basal ray and projects almost at right angles from the centre of the spicule, though, owing to the curvature of the basal ray, the two may appear,

from one point of view, to lie almost or quite in the same straight line. In a typical example the basal ray measured 0·077 by 0·0066 mm., the oral rays 0·044 by 0·0088 mm., the apical ray 0·182 by 0·0066 mm. In another specimen, in which the end of the apical ray was broken off, the remaining portion measured as much as 0·367 mm. in length. The specific name, *lancifer*, was suggested by the presence of these enormous, lance-like apical rays. They appear to be most strongly and abundantly developed near the vent.

(5) Reduced pigmy radiates with only two, very rarely three, rays (fig. 14); these closely resemble the corresponding spicules in *Leucettusa tubulosa*, the rays being somewhat fusiform, sharply pointed, and measuring about 0·013 by 0·004 mm., or narrower.

This species is readily distinguished from *Leucettusa tubulosa*, which occurs in the same locality, by its external form, by the ingrowth of the medullary tissue into the central gastral cavity, and by the shape of the pigmy quadriradiates; also, perhaps, by the absence of large quadriradiates, which I have been unable to find. The endogastric proliferation of the medullary tissue occurs also in *Leucettusa dictyogaster*, Row MS., but that species is at once distinguished by the presence of microxea.

Register Nos., Locality, &c.—XIV. 2; XLIII; both from Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

Family HETEROPIIDÆ.

4. *Grantessa poculum* (Poléjæff). (Pl. I, fig. 19.)

Amphoriscus poculum, Poléjæff [1883]; *Heteropia patulosculifera*, Carter [1885–6]; *Grantessa poculum*, Dendy [1892]; *Grantessa poculum*, Dendy and Row [1913].

This fairly well-known Australian species is represented in the collection by a single rather small specimen which we identify with Poléjæff's species on the strength of direct comparison with the "Challenger" type in the British Museum collection. The specimen before us has the form of a cylindrical tube about 19 mm. in length and 3 mm. in diameter, bent almost at right angles at a point not far from the middle. The two ends are damaged, so that it is impossible to say whether or not they carried vents, but there is a single slightly prominent vent on the outer side of the curve at the point where the tube is bent.

The "Terra Nova" specimen differs in certain minor details from the "Challenger" example as described by Poléjæff, but we are inclined to think that these discrepancies are apparent rather than real. They concern chiefly the following points:—(1) Poléjæff describes no special peristomial skeleton, saying simply that "the individual is bare-mouthed". Our specimen has a normal peristomial skeleton of alate triradiates (which occasionally develop a short apical ray) and a fringe of hair-like oxea, all of which, however, are broken short so that the "mouth" appears to be "bare". It is not

clear whether or not Poléjæff examined the vent of his specimen microscopically. (2) The large oxea have broad, flattened lance-heads at their distal extremities. Poléjæff says that these spicules are "usually spindle-shaped, often lanceolate, sharp-pointed," and gives a figure which is by no means typical. The spindle-shaped and lanceolate forms which he distinguishes are probably merely different views of the same form. As he remarks, the outer ends are usually broken off, but in our preparation of the "Challenger" type we find one perfect specimen with a beautiful flat lance-head, closely resembling those of the "Terra Nova" sponge (fig. 19).

Previously known distribution.—Off Port Jackson, Australia (Poléjæff); neighbourhood of Port Phillip Heads (Carter, Dendy).

Register No., Locality, &c.—XIX. 1. *a*; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

Family GRANTIIDÆ.

5. *Grantia ramulosa*, n. sp. (Pl. 2.)

There is a large quantity of this very remarkable sponge in the collection. It seems to have grown freely on the sea bottom as a tangled mass of long, slender tubes, resembling so much vermicelli, with a very few much wider pieces more like macaroni. There are no recognisable points of attachment. The tubes (figs. 1–5) vary in diameter from about 1 mm. to about 10 mm., the wider ones being flattened. The usual diameter is only about 2 mm. Although fairly soft and quite flexible they readily break across, and it is impossible to say what length they may attain. One of the longest measures about 100 mm., with a diameter of about 2 mm. They are sparingly and irregularly branched, but there appears to be no true anastomosis of the branches; very rarely, however, two tubes lying side by side may become adherent. The vents are terminal or lateral, in the latter case more or less prominent. They usually, perhaps always when perfect, have a delicate peristomial fringe of hair-like oxea. The surface of the sponge is minutely hispid; the colour in spirit is white.

The wall of the tube is thin in comparison with the width of the central gastral cavity. In a tube having a total diameter of about 4 mm. the wall measures only about 0·34 mm. in thickness. The dermal and gastral cortices are both fairly well developed, each about 0·051 mm. thick, where the thickness of the chamber layer is 0·238 mm. The flagellate chambers are thimble-shaped and extend radially through the chamber layer from gastral to dermal cortex. Sometimes two, or possibly more, unite together to open through a short common exhalant canal into the central gastral cavity. The nuclei of the collared cells are, as might be expected, apical.

The skeleton of the dermal cortex consists of several layers of slender-rayed triradiates, tangentially disposed, but without any other definite orientation. That of the gastral cortex consists partly of a very sparse layer of slender-rayed tangential quadriradiates orientated in the typical manner, but largely of the paired rays of the

subgastral radiates, which have a strong tendency to lie parallel with one another in dense bundles, the bundles forming a loose network in the deeper part of the gastral cortex. The skeleton of the chamber layer consists chiefly of the centrifugal basal rays of the subgastral radiates, which extend right through it, commonly in bundles, and may project slightly beyond the dermal surface. There are also, however, a few triradiates whose paired rays are extended in the chamber layer itself, parallel to and at various depths between the dermal and gastral cortices, while the basal ray is directed outwards. These triradiates, though no longer related to individual chambers, may probably be taken to represent the articulate tubal skeleton. The chamber layer is further supported by the proximal portions of large, radially arranged oxea, which commonly extend right through the chamber layer and project beyond the dermal cortex for about one-third of their length, while their inner extremities may project slightly into the gastral cavity. The gastral surface is abundantly echinated by the short, sharp, apical rays of the gastral quadriradiates, and also by the very peculiar, slender, saw-like oxea. There is a well-developed oscular skeleton, consisting, in the first place, of a dense layer of alate radiates, some of which develop a short apical ray, and which are arranged in the usual manner, with the oral rays parallel to the oscular margin, and, in the second place, of a dense fringe of long, hair-like oxea arranged longitudinally, and springing from inside the feltwork of alate radiates.

Spicules.—(1) Dermal triradiates (fig. 11); irregular, but with a sagittal tendency, two rays being usually shorter than the third, often unequal, however, and making an angle of less than 120° with one another; rays slender, almost cylindrical, straight or slightly crooked, sharply or bluntly pointed.* In a typical example the basal ray measured 0·265 by 0·015 mm., and the two others 0·15 by 0·015 mm. and 0·22 by 0·015 mm. respectively.

(2) Triradiates of the chamber layer (fig. 12); more or less sagittal, but with the basal ray not much longer than the other two; paired rays often bent and curved towards one another in a plane at right angles to the facial plane; rays moderately stout, gently tapering, sharply or bluntly pointed; size very variable; in a typical example the basal ray measures about 0·165 by 0·015 mm., one of the paired rays measures about 0·135 by 0·015 mm., and the other about 0·125 by 0·015 mm.

(3) Subgastral sagittal triradiates (fig. 6): the three rays usually meet at approximately equal angles, but the paired rays are bent sharply backwards at a short distance from their origin, so as to lie almost in line with one another and almost at right angles to the basal ray; the three rays lie throughout their length in approximately the same plane. The rays are long and slender, nearly cylindrical, very straight except for the sharp backward bending of the paired rays above referred to; usually bluntly pointed when seen in facial view in preparations boiled out with

* It is just possible that the blunting of the apices may be partly due to the action of caustic potash upon boiled out spicules, as they certainly seem to be sharper when seen *in situ*.

caustic potash ; the paired rays much more sharply and finely pointed when viewed edge on, as when the gastral cortex is looked at from the inside (apparently all three rays are somewhat flattened in the facial plane, and this is probably true of most radiates). In a typical example the paired rays measured about 0·26 by 0·01 mm. and 0·24 by 0·01 mm. respectively, and the basal ray about 0·28 by 0·01 mm., but the paired rays may be very unequal in length. These spicules may occasionally develop a short apical ray.

(4) Gastral quadriradiates (fig. 8) ; sagittally differentiated, but very variable in the relative lengths of the rays. The basal ray is straight and may be longer or shorter than the orals, the latter being more or less crooked and frequently unequal. The apical ray is short, slightly curved and sharply pointed. The facial rays are usually long and slender, of nearly uniform diameter for by far the greater part of their length ; apparently much more sharply pointed when seen edge on than in facial view. In a typical example the basal ray measures 0·25 by 0·01 mm., one of the oral rays the same, and the other 0·155 by 0·01 mm.

(5) Radiates of the oscular skeleton (fig. 7) ; alate, with the paired rays extended at right angles to the basal ray ; basal rays usually long, but, to judge from boiled out preparations, may be greatly reduced and quite short. Frequently these spicules develop a short apical ray ; they are connected by forms intermediate in shape and position with the gastral quadriradiates.

(6) Large oxea (fig. 10) : stout, subfusiform, slightly curved, somewhat flattened and much more refringent when viewed edge on ; proximal half tapering more gradually and to a finer point than distal half, which is rather broadly rounded in flat view. Typical examples measure about 0·53 by 0·25 mm.

(7) Trichoxea ; the hair-like oxea of the oscular fringe ; straight and very slender ; say about 0·07 mm. in length.

(8) Saw-like oxea (figs. 9, 9 *a*). These spicules are very peculiar ; they are long and rather slender, more or less bluntly pointed at each end and gently curved in one plane in the form of a very open S. The margin of the distal fourth or fifth is serrated on the concave side. When viewed edge on (fig. 9 *a*) the spicule appears straight and the serrations are seen to form a double row ; in this position also the spicule is more highly refringent. Typical examples measure about 0·27 by 0·005 mm. They project for the greater part of their length from the gastral surface and are abundant in places. (The above description is taken from preparations boiled out in caustic potash ; when seen *in situ* the spicules appear finely pointed, at any rate at the outer ends, and we are inclined to think that the potash may have had some effect in blunting the extremities.)

This is a remarkably well characterised species and nothing at all resembling it seems to have been described hitherto. The external form and mode of growth remind one of *Leucilla saccharata*, but on a much smaller scale. The peculiar saw-like oxea are, so far as I know, quite unique.

Register No., Locality, &c.—XVI; Mouth of Bay of Islands, New Zealand 20 fathoms, September 28, 1911.

6. *Ute syconoides* (Carter)?

?*Aphrocceras syconoides*, Carter [1885-6]; ?*Ute syconoides*, Dendy [1892], Dendy and Row [1913].

The single specimen in the collection was obtained from the base of a specimen of *Geodia* (R. N. XXXII. 3). It is very small, having the form of a single cylindrical person about 5·5 mm. in height by 1 mm. in diameter. There is a fringe of long, slender oxea around the vent and the surface is covered with an armour of colossal longitudinal oxea, between which lie a few microxea. The radial chambers are very short, but this is probably to be attributed to the youth of the specimen.

Except for the presence of the peristomial fringe of hair-like oxea the specimen agrees very well with Australian specimens of *Ute syconoides*, though there may be minor differences in the form of some of the spicules. Unfortunately, in our memoir on the Classification and Phylogeny of the Calcareous Sponges [1913] we have, by an oversight, placed *Ute syconoides* in the section of the genus without microxea, although Mr. Carter laid stress upon the presence of such spicules ("mortar-spicules") as distinguishing his species from *Ute glabra*, Schmidt.

Previously known Distribution.—Near Port Phillip Heads (Carter, Dendy); Port Jackson (Dendy).

Register No., Locality, &c.—XXXII. 3. *c*; Station 96, 7 miles East of North Cape, New Zealand, 70 fathoms.

Order HEXACTINELLIDA.

Family ROSSELLIDÆ.

7. *Rossella ijimai*, n. sp. (Pl. III, fig. 5; Pl. IV, figs. 1–16.)

The single specimen (Pl. III, fig. 5) by which this species is represented in the collection is a sessile, goblet-shaped sponge, slightly compressed in a vertical plane, so that the wide terminal aperture is oval in outline. The colour in spirit is greyish-white. The maximum height is about 93 mm. and the maximum width 76 mm. The opening of the cup is surrounded by a narrow, thin, vertical marginal membrane, but without any special skeletal peculiarities. The wall of the cup, as a whole, is very thick and the texture rather soft, compressible, and resilient. Both outer and inner surfaces, though very uneven, are fairly smooth, there being no projecting spicules visible to the naked eye. The surfaces, however, are not glabrous but have a granular appearance. The most remarkable feature of the species is the highly cavernous character of the thick wall, which is pierced in every direction by a system of very wide, branching canals, communicating with the exterior by

numerous, irregularly scattered, rounded apertures on the outer surface of the sponge, of much smaller diameter than the canals or vestibules themselves, into which they open laterally. A somewhat similar system of wide canals is continued outwards from the central cavity of the cup, of which they are merely extensions and into which they open by much wider apertures than those on the outer surface of the sponge. This second system extends to close beneath the dermal surface, and may even communicate occasionally with the exterior by small rounded apertures, and in the same way the first-mentioned system may, I think, occasionally communicate with the central cavity. Whether or not, or to what extent, the two systems of canals communicate with one another it is impossible to determine without destroying the specimen, but one may safely say that, taken as a whole, they form distinct systems.

The cavernous character of the sponge wall, just described, is evidently very similar to that described by Ijima [1904] in his *Crateromorpha corrugata*.

The ends of the comparatively very narrow, true inhalant and exhalant canals, communicating with the flagellate chambers, appear to be normally covered over by a thin, pore-bearing membrane ; where this has been, presumably, abraded, the outer surface of the sponge appears pitted between the relatively large circular openings.

The arrangement of the skeleton is normal. The main skeleton is a very loose and irregular network, formed of bundles of diacts, with many loose diacts scattered between. The differentiation of this skeleton to form a special subdermal and subgastral reticulation is not strongly marked, and the different bundles or fibres appear everywhere to cross one another without making any firm junctions.

Immediately below the dermal surface the paratangential rays of the large hypodermal pentacts form a polygonal-meshed network supporting the pore-bearing dermal membrane, while their unpaired rays are directed inwards (centripetally). A few variously orientated, rough-rayed hexacts are mingled with these pentacts. On the gastral surface the pentacts are few or absent and the hexacts more numerous, the typical orientation, of course, being with four rays disposed paratangentially.

The lining membrane of the wide canals or vestibules (" intercanals " of Ijima), which run in from beneath the dermal surface, appears to be devoid of both hexacts and pentacts, and to be supported only by a loose network of diact bundles or fibres, so that we can hardly say, as Ijima does of *Crateromorpha corrugata*, that the intercanals " are throughout lined with the dermal layer."

Spicules :—(1) Diacts : long and slender, but very variable in size and proportions. Often, especially the shorter ones, slightly angulated in the middle and with approximately central inflation. Ends roughened, usually pointed, sometimes more or less enlarged. Two principal forms occur, connected by intermediates :—

(*a*) Very long and slender, up to at least 5·2 by 0·006 mm. ; or shorter and stouter, e. g. 4·0 by 0·012 mm.

(*b*) Relatively short and stout, e. g. 0·63 by 0·0082 mm. (Pl. IV, fig. 1.)

(2) Hexacts (fig. 2): regular, with approximately equal, usually sharp-pointed rays, more or less roughened, especially towards the tips; usually smooth towards the base; measurement of ray about 0·1 by 0·006 mm. Occasionally reduced to pentacts (fig. 3).

(3) Pentacts (fig. 4): with straight and approximately equal rays, only slightly roughened at the tips; tapering gradually to sharp points. Ray measuring about 0·225 by 0·0164 mm. The sixth ray usually represented by a very distinct, rounded knob or boss.

(4) Oxyhexasters (figs. 5–11): very abundant throughout the sponge; varying in total diameter from about 0·033 to about 0·086 mm. Rays smooth and slender; principals very short; secondaries long and tapering gradually to fine points, varying in number from 4 to 1 on each principal. Extreme modifications of these spicules are the remarkable curved diacts shown in figs. 7 and 8.

(5) Calycocomes (figs. 12–15): fairly abundant throughout. Secondary rays varying from about 6 to 1 on each principal, terminating in very small knobs. There are two chief forms of this spicule, connected by intermediates:—

(*a*) Small, about 0·053 mm. in total diameter, with comparatively short rays (figs. 13, 14).

(*b*) Large, about 0·082 mm. in total diameter, with comparatively long and very slender rays (figs. 12, 15).

(6) Irregular discohexasters (fig. 16): so rare that I was only able to find a single broken specimen for drawing, and probably to be regarded merely as abnormalities of the calycocome.

There is nothing remarkable about the spiculation of this species, the chief distinctive character of which is undoubtedly the cavernous character of the sponge wall, which, so far as is known, appears to be unique in the genus *Rossella*, though met with, as already stated, in the closely related genus *Crateromorpha*.

Register No., Locality, &c.—XVIII. 1; Station 96, 7 miles east of North Cape, New Zealand. Depth 70 fathoms; bottom sand and rock.

Genus Symplectella, n. gen.

Sponge directly attached, without stalk and without root-tuft. Consisting of a number of wide, thin-walled, more or less upright, laterally anastomosing tubes, the upper ends of which, lying all at the same level, are covered over by a large, common sieve-plate. There are a few small accessory vents situated on lateral projections, but the sponge-wall, generally speaking, is imperforate. The main skeleton consists of loosely interwoven bundles of diacts, without firm junctions. Large, stout, short-rayed hexacts occur abundantly scattered through the parenchyma. The dermal skeleton is very poorly differentiated, consisting chiefly of hexacts of various sizes. Oxyhexasters and calycocomes are present. No floricomes.

This interesting genus seems to come most naturally in the family Rossellidæ, but appears to be not without affinities with the Euplectellidæ.

8. *Symplectella rowi*, n. sp. (Pl. III, figs. 1-3 ; Pl. IV, figs. 17–39.)

This very beautiful and remarkable species, which I dedicate to my late friend and colleague, R. W. Harold Row, is represented in the collection by three specimens, two in spirit and one dry. The last-named is not labelled, but the presumption is that they all come from the same locality. The larger of the spirit specimens (R. N. XV) had, unfortunately, been crammed into a jar that was much too small for it and was consequently much damaged. The smaller (R. N. XXVI) was also a good deal damaged on one side, but is still in a fair state of preservation. The dry specimen (R. N. XXXIII. 11), of about the same size as the larger spirit specimen, was reduced to the condition of a shapeless mat, and must be neglected for purposes of description.

R. N. XV (Pl. III, fig. 1) may be regarded as the type of the species. Taken as a whole it may be described as roughly columnar in form, with an approximately circular, depressed top, formed by the common sieve-plate. It is really, however, made up of a number of very wide, thin-walled tubes, ascending almost vertically and anastomosing with one another laterally by short cross-tubes of similar width, or branching out from one another as they ascend. The total height is about 130 mm., and the diameter at the top about 170 mm. Unfortunately the sponge has been torn off from its attachment in such a way that there is no clue to the nature of the latter ; the smaller specimen, however, to be described later, to some extent supplies this deficiency.

The component tubes are approximately cylindrical in shape and about 33 mm. in diameter, with walls not more than 2 or 3 mm. in thickness.

The terminal sieve-plate may be said to be common to the whole of the tubes, but the grouping of the apertures still shows, to some extent, its composite character, for they are interrupted where the walls of the tubes reach the surface. These apertures are rounded or polygonal in form and average about 4 mm. in diameter, they are separated by trabeculæ about 1·5 mm. in diameter.

The outer or dermal surface of the tubes shows a fine lattice-work of closely interwoven trabeculæ, with rounded or oval meshes varying greatly in diameter (up to about 3 mm.). These meshes are the openings of pits of varying depth, which never appear to penetrate right through the wall. Occasionally a conical prominence on the wall of a tube bears at its apex a small accessory vent, but these are rare. Nowhere are there any projecting spicules visible to the naked eye.

The gastral surface of the tubes is subglabrous, covered over by a thin, pore-bearing, gastral membrane.

The texture of the sponge is fragile, compressible and resilient ; the colour light

brown, apparently artificially stained, for the other spirit specimen is very pale yellow and the dry specimen greyish-white.

The smaller spirit specimen (R. N. XXVI) is about 65 mm. in height and 68 mm. in diameter at the top. It shows clearly (figs. 2, 3) that the component tubes spring from a contracted base and branch off from one another as they ascend. The base is a good deal damaged, but there is no sign of a stalk or root-tuft, and the existence of a small pebble and other bottom débris, attached to the surface, indicates that it was directly attached to the sea-bed. In this specimen there are a good many small perforations piercing right through the walls of the tubes.

The main skeleton is a very loose and irregular interlacement of bundles of diacts and loose diacts, without any firm junctions. Amongst these are abundantly scattered the large, stout, short-rayed hexacts so characteristic of the species. In sections taken at right angles to the surface of the sponge wall these large hexacts are seen to be roughly disposed in loose columns, corresponding to the trabeculæ of sponge-tissue which separate the principal canals, which themselves run at right angles to the two surfaces.

Immediately beneath the gastral and dermal surfaces the network of diact-bundles or fibres is more or less concentrated paratangentially to form a subgastral and subdermal skeleton respectively. On the gastral side this is overlaid by a network of single diacts, or very slender bundles, supporting the thin, pore-bearing gastral membrane.

There are no gastral hexacts (or pentacts), and even the hexasters are absent from the gastral membrane. At the dermal surface, however, there is a layer of medium-sized, regular hexacts, which seem typically to have four rays disposed paratangentially, though there is much irregularity in the orientation and no special differentiation of any of the rays. The rays of these spicules are smooth, conical and sharply pointed, measuring about 0·164 by 0·02 mm., but smaller forms, with more slender rays, also occur, which even seem to form transitions to the oxy-hexasters, which are very abundantly scattered in the dermal membrane, while, on the other hand, transitions to the large, stout hexacts of the parenchyma are not wanting.

At the surface of the trabeculæ of the terminal sieve-plate the medium-sized hexacts are either absent (or nearly so) or replaced by pentacts of similar form, with the unpaired rays inwardly directed. The trabeculæ themselves are composed chiefly of stout bundles of diacts, with a superficial layer of soft tissue containing numerous oxyhexasters in addition to the above-mentioned pentacts.

Spicules:—As it is impossible to distinguish sharply between dermalia, hypodermalia, perenchymalia, and so forth, I propose to describe the different forms of spicules chiefly as they appear in boiled out preparations (R. N. XV), without attempting to classify them according to their positions in the sponge.

(1) Diacts: very variable in size and proportions, but distinguishable roughly into the following categories:—

(*a*) Long and comparatively stout (Pl. IV, fig. 19); more or less gradually and sharply pointed at each end; ends not roughened, but frequently irregular, occasionally one end broadly rounded off. The concentric lamination of the silica on these spicules is often very obvious, and though they usually taper evenly to the extremities, there is sometimes a sudden diminution in diameter as shown in the figure. A typical example measured about 5·0 by 0·0246 mm.

(*b*) Long and very slender, almost cylindrical (fig. 18); ends roughened; a typical example measured about 3·8 by 0·0082 mm.

(*c*) Short, slender, nearly straight (figs. 20–22); ends varying from smooth and fairly sharp-pointed to roughened and broadly rounded; a typical example measured about 1·15 by 0·012 mm. It is only rarely that these spicules exhibit any central inflation (fig. 17).

(2) Hexacts:—(*a*) Large and stout (fig. 23); with much thickened, conical rays and large centrum. The whole spicule may somewhat resemble a large spheraster; about 0·34 mm. in total diameter, i. e. from tip to tip of opposite rays. These are the characteristic parenchymal hexacts as they appear when fully developed. They are by no means always so stout.

(*b*) Medium-sized (fig. 24); little inferior to (*a*) in total diameter, but with less thickened rays and centrum. The dermal hexacts are of this type, which, by reduction, gives rise to a comparatively few pentacts (figs. 25–27) and very rare stauracts (fig. 28).

(*c*) Rather small (figs. 29, 30); commonly with some or all of the comparatively slender rays roughened at the tips. Spicules of this type occur in the dermal or subdermal skeleton, and I suspect them to be immature forms of the larger dermal hexacts. A pentact reduction form of this type has also been observed (fig. 31).

(3) Oxyhexasters: very abundant, especially in the dermal membrane, where the commonest form is that with only 6 slender rays (fig. 32), which might easily be interpreted as a dermal hexact, but which is connected by intermediates with more typical forms (figs. 33 and 34), in which one or more of the rays is divided near the base into two branches. An interesting variety is one in which the slender rays are bent into hooks (figs. 35 and 36). The total diameter of the oxyhexaster ranges up to about 0·086 mm.

(4) Calycocomes: rather scarce, with slender secondaries bearing very minute terminal knobs. The secondaries are almost straight, and diverge only slightly from the end of each principal. This spicule occurs in two chief sizes, the larger (fig. 37) about 0·127 mm. in total diameter, and the smaller (fig. 38) about half as much, but of course intermediates occur.

(5) Very minute discohexasters (fig. 39): with stout primary and numerous very slender secondary rays. Total diameter about 0·02 mm. Apparently very scarce.

Register Nos., Locality, &c.—XV, XXVI ; Station 96, 7 miles E. of North Cape, New Zealand. Depth 70 fathoms ; bottom sand and rock ; XXXIII. 11 (Dry), Station 96 ?

Order TETRAXONIDA.

Sub-order ASTROTETRAXONIDA.

Family STELLETTIDÆ.

9. *Stelletta maori*, n. sp. (Pl. VII, figs. 8–11.)

The single specimen in the collection is laterally compressed, cushion-shaped, with a meridional ridge produced into an irregular base of attachment at one side, where it has apparently been torn off from the substratum. The surface is coarsely granular and marked with shallow, meandering grooves. Over a limited area only (one part of the ridge) it is coarsely hispid, elsewhere it is sparsely and shortly hispid or not hispid at all. There are no apertures visible to the naked eye or with a pocket lens. The colour externally is very dark greyish brown, internally light yellowish brown. The texture is fairly compact but not hard, and moderately compressible. Height about 20 mm. ; greatest breadth about 22 mm. ; thickness about 14 mm.

There is a sharply defined cortex about 1 mm. thick, clearly differentiated into an outer collenchymatous layer and an inner fibrous layer, the outer layer being somewhat thicker than the inner.

Numerous minute pores are scattered over the surface of the sponge. These lead into narrow canals which unite with one another in the outer layer of the cortex to form the chones, and then penetrate the inner layer as single canals to open into the large or small subcortical crypts. Well-developed sphincters are present around these canals in the deeper part of the fibrous layer. Most of the cortical canals and dermal pores thus described are probably inhalant, but some are probably exhalant, though I have not been able to distinguish between the two in my sections. Some of the subcortical crypts are very large and penetrate deeply into the choanosome. None of the canals in the choanosome appear to be provided with diaphragms, and there is very little collenchyma accompanying them.

The skeleton is rather lax and sparse, but the arrangement is typical, the megascleres being arranged in loose, radiating bundles. The best developed spicules are the triænes, arranged in more or less dense brushes, lying for the most part in the cortex, with the cladi at or near the surface. In the choanosome there are practically no triænes, the megascleres being oxea, usually very long and very slender, arranged in very loose radial bundles. The microscleres (asters) are enormously abundant in the choanosome but sparse in the cortex, except for an ill-defined dermal layer.

Spicules:—(1) Dichotriænes (Pl. VII, fig. 8); with the primary cladi coming off at the normal angles, but the secondaries bent back so as to lie almost at right angles to the shaft. Shaft and cladi typically stout, the former varying greatly in length and tapering gradually to a fine point; the latter bifurcating at about half their length, the secondaries conical and fairly sharply pointed. In a well-grown specimen the shaft measured about 1·8 by 0·068 mm. and the cladome about 0·5 mm. across; the primary cladi having a thickness of about 0·05 mm. Numerous small triænes with unbranched cladi (fig. 8 *a*) occur amongst the larger ones, but are evidently only young forms of the latter, as shown by intermediates.

(2) Oxea (fig. 9); very variable in dimensions, for the most part very long and often very slender, gradually sharp-pointed at each end. They may be as much as 5 mm. in length, with a diameter of not more than about 0·01 mm., or they may be considerably shorter and stouter, as in the figures, measuring, for example, about 2·55 by 0·034 mm.

(3) Oxyasters (fig. 10); ranging from comparatively large (up to 0·036 mm. in diameter), with few rays and no centrum, to comparatively small (about 0·02 mm. in diameter), with many rays and fairly large centrum. The rays are usually rather slender, smooth, conical and sharply pointed.

(4) Tylasters (fig. 11); of much the same form and size as (3), but differing in the appearance of slight knobs at the ends of the rays.

We might almost say that there are four kinds of aster, viz. large and small oxyasters and large and small tylasters, but there are so many intermediate forms that it would be equally reasonable to recognize one kind only. The larger oxyasters are by far the commonest, occurring chiefly in the choanosome, while the smaller forms occur chiefly in the thin surface layer. The tylote forms are comparatively rare.

This species is evidently closely related to Sollas's [1888] *Stelletta phrissens*, from Patagonia, and Topsent's [1904] *S.* (*Astrella*) *tuberosa*, from the Azores. It differs from *S. phrissens*, but agrees with *S. tuberosa*, in the absence of anatriænes. It differs from *S. tuberosa*, however, in the absence of the comparatively large, single oscula. In *S. tuberosa*, moreover, the asters are distinctly roughened, a feature which is rarely recognisable in the "Terra Nova" sponge.

Register No., Locality, &c.—L. 10; Station 134, Spirits Bay, near North Cape, New Zealand, 11–20 fathoms.

9 *a*. *Stelletta maori*, var. *bistellata*, nov.

A single small specimen, from the same locality as the type of the species, differs in certain interesting particulars. The specimen, which is attached by a broad base to an epipolasid sponge (L. 6, *Jaspis novæ-zealandiæ*), is roughly hemispherical in shape and about 10 mm. in maximum diameter. The surface is granular but not hispid. In its present condition, which is somewhat damaged, there are no apertures

large enough to be seen with a pocket lens, and I think it may safely be assumed that there were no conspicuous vents even in life. The colour, of surface and interior alike, is pale, dull yellow; the texture compact but fairly compressible.

The structure of the cortex and the chones is closely similar to that of the type. The differences consist chiefly in the spiculation and may be summed up as follows :—

(1) The megascleres are on the whole rather more robust and there are not nearly so many slender oxea.

(2) The asters are very sharply differentiated into two categories, distinguished chiefly by their size, viz. large oxyasters, usually with about six or seven smooth, conical, sharply-pointed rays and hardly any centrum; and minute oxyspherasters, with moderate centrum and rather more numerous, short, conical or truncated rays. The former measure about 0·04 mm. and the latter about 0·008 mm. in total diameter. The small asters form a thin but well-defined surface layer, and also occur sparsely along with the large ones and a few intermediates in the choanosome.

(3) None of the asters appear to have tylote rays.

It will be seen that as regards the asters this variety comes much nearer to Sollas's *Stelletta phrissens* than does the type of the species, but it still differs from *S. phrissens* in the complete absence of anatriænes.

It is of considerable interest to find two apparently well-marked varieties of *S. maori* occurring together in the same locality.

Register No., Locality, &c.—L. 6. *d*; Station 134, Spirits Bay, near North Cape, New Zealand, 11–20 fathoms.

10. *Stelletta crater*, n. sp. (Pl. IX, fig. 5; Pl. VII, figs. 5–7.)

There are two and a half fine specimens of this sponge from Station 96 and a fragment from Station 134. The most perfect is R. N. XXXII. 15 (Pl. IX, fig. 5), which may be regarded as the type of the species. The external form is evidently very characteristic, resembling a very thick-walled goblet, with broadly rounded margin and a broad base of attachment. The type specimen is very symmetrical, but in R. N. XXXII. 2 the wall of the cup is deficient on one side and the base of attachment is subdivided into three irregular areas. The three specimens are all of about the same size. The height of the type is about 124 mm.; the outside diameter just below the margin of the cup about 122 mm.; the diameter of the opening, measured from the middle of the rounded margin, about 100 mm.; the depth of the cavity about 60 mm., the lower part of the sponge being solid. The fragment from Station 134 is apparently a piece broken out from the wall of a similar cup-shaped specimen, including part of the margin.

In all the specimens the entire surface, except where accidentally abraded, is covered with a thin layer of an encrusting sponge belonging to the genus *Desma-*

cella,* filling up the intervals between the ends of large triænes and oxea, which project in dense brushes beyond the cortex of the *Stelletta* and, were it not for the encrusting *Desmacella*, would form a thick surface pile. The *apparent* surface of the sponge, however (really the surface of the *Desmacella*), is not hispid, but minutely granular, and on the outside of the cup is more or less deeply corrugated. In R. N. XXXII. 2 both surfaces are also sparsely studded with commensal polyps, possibly Palythoids. In most of the specimens no pores or vents are recognisable with the naked eye, but in R. N. XXXII. 16 the inner surface of the cup exhibits numerous minute, oval or slit-like punctures, which appear to be the vents of the *Desmacella*, and probably serve also as those of the *Stelletta*. The texture in spirit is firm, compact, and scarcely compressible. The colour of all but R. N. L. 9 is deep green throughout, owing to copper staining, but R. N. L. 9 is pale wax-yellow throughout (in spirit).

R. N. XXXII. 16 has been cut in half, and shows that the *Desmacella*-layer is much thicker on the outside than on the inside of the cup, measuring about 3·5 mm. in thickness in the former and 1·5 mm. in the latter case.

There is a fibrous cortex about 0·85 mm. thick, absolutely sharply defined from the overlying *Desmacella*-layer. At the inner surface of the cup the principal exhalant canals, about 2 mm. in diameter, coming from the interior of the sponge, run up to the cortex, while others seem to form a system of subcortical or cortical canals running parallel with the surface. Finally, they open through the cortex by means of sphinctrate chones. At the outer surface the cortex is penetrated by numerous narrow, inhalant chones, provided with sphincters in the deeper parts. The flagellate chambers are about 0·02 mm. in diameter. I have been unable to satisfy myself as to their mode of opening.

The arrangement of the skeleton is of the usual type. Dense bundles of large, stout oxea curve upwards from the interior towards the surface of the sponge. As they approach the surface numerous large, stout triænes become intermingled with the oxea, and finally the surface-brushes, which begin beneath the cortex and penetrate both the latter and the superjacent *Desmacella*-layer, consist almost entirely of triænes, very many of the cladi being embedded in the *Desmacella*-layer.

Spicules:—(1) Triænes (Pl. VII, fig. 6); shaft stout, more or less curved, somewhat hastately pointed at the apex, measuring about 2·1 by 0·093 mm.; cladi stout, rather short, conical, usually gradually and fairly sharply pointed, with their apices more or less strongly incurved like the petals of a tulip, measuring about 0·23 by 0·06 mm. (without allowing for the curvature). Cladi occasionally abbreviated and bluntly rounded off (fig. 6*a*), or one may be altogether suppressed (diæne, fig. 6 *b*).

(2) Oxea (fig. 5); very large and stout, fusiform, sharply pointed, more or less curved; size about 2·56 by 0·14 mm. Numerous young and slender individuals of both types of megasclere also occur.

* This is described below under the name *Desmacella vestibularis* (Wilson).

(3) Oxyspherasters (fig. 7); with numerous rather short, slender, conical rays, and a feebly developed centrum; measuring up to about 0·022 mm. in total diameter. Perhaps with slightly roughened rays.

This species is well characterised by the cup-like external form, and by the peculiar tulip-like shape of the cladome of the triænes. The most remarkable feature about it is, however, the presence of the uniformly encrusting layer of *Desmacella* in all the specimens. There is not sufficient evidence to justify us in saying that this association is constant, and, indeed, similar cases have been described in which it is certainly not so, as, for example, that of "*Seiriola compacta*," in which Hanitsch [1889] at first described an encrusting "Suberite" as an integral part of a stellettid sponge, the error being pointed out later by Sollas.

It should also be noted that the same species of *Desmacella* occurs in exactly the same association with several other stellettid species in the collection (*vide* under *Desmacella vestibularis*).

It seems certain that all our specimens of *Stelletta crater* must have both drawn and discharged their water-supply through the overlying *Desmacella*, probably making use of the canal-system of the latter, for no other means of communication with the exterior can be found, and the *Stelletta* is evidently in a perfectly healthy, growing condition.

Register Nos., Locality, &c.—XXXII. 2, 15, 16, Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms; L. 9, Station 134, Spirits Bay, near North Cape, New Zealand, 11–20 fathoms.

11. *Stelletta columna*, n. sp. (Pl. V, fig. 4; Pl. VII, figs. 1–4.)

The single specimen (Pl. V, fig. 4) is massive, erect; attached below at several points to a mass of foraminiferal rock and shell-fragments; the attachments making up altogether a broad but interrupted base. The entire sponge seems to be made up of four subcylindrical columns, growing up side by side and fused together throughout almost their entire length. Two of the columns are sharply truncated at their upper ends, giving rise to two well-defined, flat, or slightly concave, oscular surfaces with irregularly rounded outlines, one much larger than the other. The two remaining columns taper out above, against the side of the larger one, to which they appear to form buttresses.

The total height of the specimen is about 145 mm.; the breadth at the base about the same. The maximum thickness, half-way up, is about 65 mm. The larger of the two oscular areas, at the top of the larger column, is somewhat oval in shape, and its longer diameter measures about 53 mm.

The texture is firm, compact, and incompressible, but rather brittle. The colour is now green, like that of the other specimens from the copper tank.

The lateral surfaces of the columns, in certain parts where they have been protected from friction, are coarsely hispid. How far this hispidation was general in

the living sponge it is impossible to say. Sections show at once that the surface is really coated with a layer, about 1·5 mm. thick, of another sponge, viz. *Desmacella vestibularis* (Wilson). This layer covers the flat, oscular surfaces at the tops of the columns, as well as the lateral surfaces.

The cortex beneath the lateral surfaces of the sponge is about 1 mm. thick and more or less fibrous throughout, but especially so in its inner half.

The outer portion contains numerous coarsely granular, darkly staining cells, embedded in a gelatinous matrix. Often layers of these granular cells alternate with layers of fibrous tissue.

Beneath the oscular surfaces the cortex is much thicker, up to about 4 mm., and its outermost portion is crowded with curious little sausage-shaped bodies, which appear to be perfectly homogeneous in structure and stain fairly darkly with borax-carmine. They measure about 0·016 by 0·004 mm. They are less numerous in the lateral cortex. They seem to bear some relation to the coarsely granular cells, from which they may possibly originate.

The choanosome is also densely crowded with large, rounded, coarsely granular cells about 0·02 mm. in diameter, which stain very deeply with borax-carmine. These are accompanied by numerous sausage-shaped bodies like those found in the outer layer of the cortex. These sometimes lie actually in the cells, more or less surrounded by the coarse granules, and sometimes free between the cells. I am inclined to regard all the granular cells as thesocytes containing storage products, but the state of preservation of the material does not admit of satisfactory histological observations.

For the same reason nothing can be said of the flagellate chambers, but the more superficial parts of the canal-system exhibit features of considerable interest. In the first place, the canal-system communicates with the exterior only through the overlying *Desmacella*-crust, and evidently not through mere breaks or discontinuities in the latter, but through its own proper canal-system, though everywhere the two sponges are absolutely sharply delimited from one another, and there is not even any admixture of microscleres. The only exception to this statement lies in the fact that the ends of many of the megascleres of the *Stelletta* project into the *Desmacella*, and this exception is apparent rather than real.

Dermal pores, about 0·017 mm. in diameter, are thickly scattered on the outer surface of the lateral cortex. Each of these pores forms the termination of an inhalant canal in the *Desmacella*-crust, and at the same time leads into a very short canal in the outer part of the *Stelletta* cortex. These short canals open in groups into very wide, irregular chones, which penetrate into the deeper part of the cortex, narrowing as they go, until they reach the sphincters which separate them from the wide, subcortical crypts.

Wide oscular tubes, up to about 3 mm. in diameter, run vertically up to the oscular areas. The ends of these tubes form a system of subcortical crypts, which

open through narrow sphincters, situate at the inner limit of the cortex, into wide chones. The latter are roofed over by a thin, pore-bearing membrane densely charged with minute asters. These exhalant pores are about 0·01 mm. in diameter and are arranged in groups corresponding to the chones, between which lie the brushes of megascleres. Over these pore-areas lie wide canals in the *Desmacella*-crust, and the water must find its way out through the vents of the latter, which are small and scattered, and rather slit-like.

The evident adaptation of their respective canal-systems to one another suggests something more than a mere accidental association of the two sponges, but, as we have already seen, the *Desmacella* occurs also on other sponges from the same locality.

The arrangement of the skeleton is normal. Loose bundles of large oxea, mingled with plagiotriænes, radiate from the interior to the surface of the sponge, spreading out into brushes as they approach the latter, and extending beyond it to the surface of the *Desmacella*-crust, which latter contains most of the cladomes of the plagiotriænes.

Spicules:—(1) Plagiotriænes (Pl. VII, fig. 1); with short, conical, fairly sharply pointed, slightly incurved cladi; and very long, slightly curved shaft, tapering gradually to a fairly sharp point. Shaft about 3·2 by 0·1 mm.; cladi about 0·34 by 0·076 mm.

(2) Oxea (fig. 2); long, stout, fusiform, slightly curved, tapering gradually to a fairly sharp point at each end. Size about 4·25 by 0·09 mm.

(3) Large oxyspherasters (fig. 3); with relatively small, but well-defined centrum, about 0·02 mm. in diameter, and long, conical, smooth, sharply pointed rays, about 0·048 mm. in length, and 0·008 mm. in diameter at the base. The number of rays varies from about seven to about fifteen.

(4) Minute oxyspherasters (fig. 4); with relatively large centrum and numerous short, conical rays; total diameter about 0·012 mm.

The two kinds of aster are very sharply contrasted with one another, and there are very few intermediates. The large ones are almost confined to the choanosome, while the small ones are abundant in a thin layer at the true surface of the sponge, and also in the walls of the larger canals.

Register Nos., Locality, &c.—XXXII. 4 and 5 (parts of same specimen); Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

Genus Ancorina, Schmidt [1862].

Stellettidæ in which the microscleres include microrhabds in addition to euasters; the former are commonly minutely spined or roughened and usually form a dermal layer. There are no trichodragmata.

The much-needed revision of the Stellettidæ, to which I referred in my Report on the Astrotetraxonida of the "Sealark" Expedition [1916 B], has not yet been carried

out, but in the meantime it seems sufficiently clear that the genera *Ecionemia* and *Ancorina* cannot be distinguished from one another and that the latter name must take precedence. I have therefore abandoned *Ecionemia* and transferred the diagnosis which I gave (*loc. cit.*) of that genus to *Ancorina*.

12. *Ancorina progressa*, Lendenfeld [1906], var. *diplococcus* nov.

A single, rather small, irregularly rounded specimen of this sponge occurs, along with other sponges, in a heterogeneous mass made up chiefly of *Histodermella australis*. The colour in spirit is light yellowish grey, and there are no visible vents. There is a very thick cortex, fibrous in its inner half and containing the cladomes and the greater part of the shafts of the dichotriænes, arranged in dense, radiating brushes. This variety differs from the type of the species chiefly in the dimensions of the spicules, typical examples of which measure as follows:

(1) Dichotriænes; shaft 0·93 by 0·076 mm., with cladome 0·63 mm. across.

(2) Oxea; up to 2·0 by 0·05 mm.

(3) Oxyasters (with slightly roughened rays); about 0·028 mm. in total diameter.

(4) Microrhabds (not quite so spiny as represented by Lendenfeld and distinctly double in appearance); only about 0·004 mm. long; resembling diplococci, whence the varietal name.

The microrhabds are thus only about one-third as long as those of the type of the species. The oxyasters are also considerably smaller than those of the type. The dichotriænes, on the other hand, are considerably larger than in the type, while the oxea are smaller. These differences are perhaps sufficient to merit specific distinction, especially considering the wide difference of locality, the type having been obtained from the Agulhas Bank, near the S. African coast, by the "Valdivia" [Lendenfeld, 1906].

Register No., Locality, &c.—L. 1. *a*; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

13. *Ancorina stalagmoides*, n. sp. (Pl. III, fig. 4; Pl. VII, figs. 12–15.)

There are two fine specimens of this sponge in the collection, both, unfortunately, dry. The external form is well represented in Pl. III, fig. 4, and is closely similar in the two cases. The sponge is massive, erect, very irregular, with a wide but shallow depression on top. The outer surface is deeply corrugated, with stalagmoidal outgrowths in the form of vertical ridges with outward- and sometimes downward-growing, bluntly rounded projections. The development and subsequent fusion of these projections causes a slight amount of fenestration. The attachment to the substratum has evidently been, not by a single wide base, but by a number of irregular areas of varying size. The depressed area at the top of the sponge resembles a flat-bottomed valley surrounded by a mountainous range, interrupted

in some places and rising to varying heights in others. Over the bottom of the depression a number of fair-sized vents, ranging up to 3 or 4 mm. in diameter, are very unevenly distributed. These vents, however, clearly belong primarily to an encrusting *Desmacella*,* and it is impossible to say what is their relation to the *Ancorina*. A few similar vents may sometimes be observed on the truncated or even depressed end of one of the processes projecting from the outer surface (R. N. XXXIII. 6). The height of the figured specimen is about 190 mm., and the greatest breadth about 170 mm. The colour of the dry specimens is light brown, and the texture hard and incompressible. The entire surface of both specimens appears to have been coated with a thin *Desmacella*-crust, similar to that of *Stelletta crater*. This very readily rubs off from the dry sponge, but much of it still remains.

It is impossible to give any details as to the canal system or histology, but vertical sections of the dry sponge suggest the presence of a collenchymatous rather than fibrous ectosome. In such a section the ectosome measures about 0·68 mm. in thickness and the *Desmacella*-layer nearly 1·7 mm.

The skeleton arrangement is typical. Dense sheaves of large, stout oxea curve from the interior and approach the surface, where they terminate in radially arranged brushes of large triænes, whose cladi occur partly in the ectosome but still more in the *Desmacella*-layer outside it, projecting far beyond the proper surface of the *Ancorina*.

Spicules:—(1) Dichotriænes (Pl. VII, fig. 12); shaft long, rather stout, tapering very gradually to a sharp or rounded apex, usually more or less curved; cladi stout, bifurcating near the middle, primaries projecting well forward, secondaries more outward; the latter conical and fairly sharply pointed. In a typical specimen the shaft measured 3·3 by 0·09 mm.; the primary cladi about 0·17 by 0·068 and the secondaries about 0·22 by 0·59 mm. Variations of this type occur, in which one, two, or all three of the cladi may remain unbranched (fig. 12 *a*), and occasionally an abnormality occurs in which an additional cladus springs from the shaft at some little distance below the cladome.

(2) Oxea (fig. 13); large, stout, fusiform, slightly curved, tapering gradually to a fairly sharp point at each end. A typical example measures about 3·9 by 0·1 mm.

(3) Oxyasters (fig. 14); with about ten rather slender, not very sharply pointed rays; varying up to about 0·02 mm. in total diameter.

(4) Microrhabds (fig. 15); very minute, about 0·006 mm. long, usually deeply constricted in the middle, Diplococcus-like.

This appears to be a well-marked species with a characteristic external form.

Register Nos., Locality, &c.—XXXIII. 1, 6; off Three Kings Islands, north of New Zealand.

14. *Ancorina alata*, n. sp. (Pl. V, figs. 1 and 2; Pl. VIII, figs. 1–7.)

There are two almost complete specimens of this species in the collection and

* *Desmacella vestibularis* (Wilson).

two fragments, all from the same locality. The external form appears to be characteristic,* the sponge being lamellar and incompletely folded into a funnel, produced at one side into a wing-like extension (Pl. V, figs. 1 and 2). In one specimen (R. N. XXXII. 6) there is a single stalk of attachment, in the other (R. N. XXXII. 8) there are two. In the former the wing-like extension of the funnel is very irregular and fenestrated. The margin is narrow, but rounded and slightly undulating. Both inner and outer surfaces are smooth and even subglabrous in spirit, but the outer surface (more especially) is uneven. There are no vents visible to the naked eye, but the inner surface is abundantly strewn with very minute procts, many of which are visible under a pocket-lens. These procts frequently appear to be collected into irregular, sieve-like areas. The outer surface bears the still more minute inhalant pores, visible only under the microscope. The two specimens are nearly of the same size ; the larger measures about 280 mm. in greatest horizontal diameter and 170 mm. in height. The lamella, apart from the stalk, averages 10 mm. in thickness. The texture in spirit is firm, hardly compressible, and compact, but brittle. The colour is now green, owing to the action of copper from the vessel in which the specimens were preserved.

The inhalant pores, averaging about 0·05 mm. in diameter, are thickly scattered over the outer surface, and lead by means of chones through the thin, fibrous cortical layer and between the cladi of the triænes, into irregular subcortical crypts, from which the principal inhalant canals run in at right angles to the surface. The flagellate chambers are small and probably aphodal or diplodal. The principal exhalant canals run to the inner surface, where they open by means of the minute procts already mentioned, the latter varying up to about 0·17 mm. in diameter and being arranged in small groups over the ends of exhalant chones. Between the latter and the ends of the main exhalant canals is interposed a system of subcortical canals running parallel to the surface.

The preservation of the material is not sufficiently good to allow of a satisfactory description of histological details, but the following points may be observed. There is a large amount of collenchymatous tissue around the larger canals (both inhalant and exhalant), which are provided with diaphragms at frequent intervals. Beneath the thin, fibrous cortex of the inner surface there is, at any rate in places, a great thickness of apparently cystenchymatous tissue, the cells of which (thesocytes?) contain numerous minute brown granules. There are also numerous masses, about 0·016 mm. in diameter, of coarser and more darkly coloured, brown pigment granules, probably of the same nature as the foregoing, but scattered most abundantly beneath the margin of the sponge, and more conspicuous beneath the outer than beneath the inner surface. The presence of all this pigment leads one to conclude that the sponge was probably brown in life, but it is almost absent from the deeper parts of the interior.

* It is, however, conceivably due to local conditions, such as currents.

The arrangement of the skeleton presents no distinctive features. From this point of view the thickness of the sponge-lamella may be divided into outer, middle, and inner zones. The outer zone occupies about one-third of the total thickness, the middle zone rather more than one-third, and the inner zone about one-fourth. In the middle zone the skeleton consists of a loose and confused interlacement of stout oxea. In the outer zone it consists almost entirely of stout, radially arranged plagiotriænes, with their cladi extended in the thin, fibrous cortex. These spicules exhibit but slight indications of arrangement in bundles, and only a few large oxea are associated with them. There are also a few long, slender anatriænes, whose cladi may project beyond the surface, and a few short, hair-like oxea, arranged radially at and beneath the surface. The arrangement in the inner zone is essentially similar to that in the outer, but the bundles formed by the shafts of the plagiotriænes are more distinct and are continued inwards by the associated oxea.

Spicules:—(1) Plagiotriænes (Pl. VIII, fig. 2); large and stout, with gradually tapering and fairly sharply pointed shaft (occasionally rounded off broadly at the end); cladi conical, fairly sharply pointed, slightly reflexed towards the tips; rarely bifurcating close to the tip. Shaft about 1·9 by 0·051 mm., with cladi about 0·27 by 0·043 mm.

(2) Anatriænes (fig. 1); with long, slender shaft, tapering to a very fine point, and short, gently recurved, sharp, hook-shaped cladi. Shaft about 2·5 by 0·01 mm., cladome about 0·037 mm. across.

(3) Oxea (fig. 3); large, stout, gradually sharp-pointed, more or less curved, sometimes almost angulated in the middle; about 2·4 by 0·068 mm. These spicules are occasionally modified into stylote (fig. 4) or even strongylote (fig. 5) types.

(4) Oxea; short, very slender, hair-like; about 0·16 by 0·0013 mm. Arranged radially near the surface.

(5) Tylasters (fig. 7); with from about 4 to about 8 slender, minutely capitate rays, perhaps slightly roughened. Total diameter about 0·015 mm. Numerous, but unequally distributed through the sponge.

(6) Microrhabds (fig. 6); short, stout or slender, minutely roughened; may be slightly centrotylote. The stouter ones about 0·01 by 0·003 mm. Mostly collected in a thin layer on each surface, but also fairly abundantly scattered in parts of the interior.

This is a perfectly typical *Ancorina*, at any rate as regards spiculation. It evidently comes near to *Stelletta lobata*, Kieschnick [1898], from Amboyna.

Register Nos., Locality, &c.—XXXII. 6, 8, 12, 13; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

15. *Ancorina osculifera*, n. sp.

The single specimen forms a triangular fragment about 120 mm. in height and up to 40 mm. in thickness. Two sides of the triangle are formed by broken surfaces,

the third is the natural margin, broadly rounded and bearing numerous vents irregularly scattered over it, not in single series. These vents range in diameter from less than 1 mm. to about 4 mm., and form the terminations of vertical oscular tubes. Both surfaces of the sponge are smooth but rather uneven, and in spirit subglabrous, except where worn, and both are thickly beset with minute pore-sieves overlying small inhalant chones. The texture is hard, compact, and little compressible. The colour now is green throughout, owing to copper staining. Sections show an abundance of brown pigment in the more superficial parts of the sponge.

The skeleton is arranged as in *Ancorina alata*, but the radial bundles of plagiotriænes and stout oxea have associated with them numerous very long and slender oxea, which seem to take the place of the anatriænes of the former species, while anatriænes appear to be entirely wanting.

Spicules:—(1) Plagiotriænes; large and stout, with gradually tapering and fairly sharply pointed shaft (occasionally rounded off broadly at the end); cladi conical, fairly sharply pointed, slightly reflexed towards the tips; shaft measured up to 3·23 by 0·051 mm., but this is exceptionally long; a more ordinary size is about 2·7 by 0·055 mm., with cladi about 0·255 by 0·051 mm.

(2) Oxea; large, stout, gradually sharp-pointed, more or less curved, sometimes almost angulated in the middle; about 2·65 by 0·06 mm. May become stylote or even strongylote by rounding off of one or both ends.

(3) Oxea; long, very slender, almost cylindrical, but gradually and finely pointed at each end, straight, or nearly so; about 3·9 by 0·0127 mm.

(4) Oxea; short and very slender, hair-like; about 0·24 by 0·002 mm. (arranged radially near the surface).

(5) Tylasters; with slender, minutely capitate rays, up to about eight in number. Total diameter about 0·0082 mm.

(6) Microrhabds; short, stout or slender, minutely roughened, may be slightly fusiform, with blunt ends. The stouter ones about 0·008 by 0·0027 mm.

In most respects this sponge so closely resembles *Ancorina alata*, described above, from the same locality, that I at first regarded it as a mere variety of that species, distinguished by the arrangement of the vents. On discovering, however, that there were no anatriænes, and that the place of these was taken by the very characteristic long, slender oxea, I came to the conclusion that it was necessary to propose a new species. The smaller size of the microscleres is also, perhaps, characteristic, but, with the exception of the points mentioned, the spiculation so closely resembles that of *A. alata* that I have not thought it necessary to give any figures.

Register No., Locality, &c.—XXXII. 10; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

16. *Ancorina novæ-zealandiæ*, n. sp. (Pl. VIII, figs. 8–15 *b*.)

The single specimen is massive, irregular, tuberous, with (to the naked eye)

minutely roughened rather than hispid surface. The surface is almost everywhere intact, and very clean, and the sponge appears to have lain free on the sea-bottom. There are no visible vents. The texture is hard and compact and the colour in spirit white. The maximum diameter is about 118 mm.

Paraffin sections show numerous multisphinctrate canals running in at right angles from small, single apertures thickly scattered over the surface. These canals seem to increase greatly in diameter as they pass inwards. It is impossible to say whether they are exhalant or inhalant.

The ectosome is rather thin and very ill-defined, with only a moderate amount of fibrous tissue. In the choanosome the flagellate chambers are restricted to relatively small "islands," separated by large areas of gelatinous tissue containing an immense number of large oval cells with very small nuclei, and often highly granular cell-contents. These I take to be storage cells or "thesocytes."

The skeleton arrangement is typical. Bundles of large oxea, mingled with triænes, radiate outwards from the interior of the sponge and spread out in brushes as they approach the surface. At the surface there is a layer of small, slender oxea radially arranged and projecting beyond the surface so as to give it a densely but shortly hispid character. In the "pile" thus formed are included the projecting ends of large oxea, plagiotriænes, anatriænes and mesotriænes. At and below the actual surface is a dense crust of microrhabds, about 0·085 mm. thick.

Spicules:—(1) Plagiotriænes (Pl. VIII, fig. 12); with long, stout shaft, straight, or nearly so, and tapering gradually to the apex, which is rather abruptly pointed; with short, stout, conical, unbranched cladi,* only slightly recurved towards the apex; shaft up to about 4·0 by 0·093 mm., with cladi 0·22 by 0·068 mm.

(2) Anatriænes (fig. 11); with long, straight, slender shaft, tapering gradually to a fine point, and very strongly recurved, gradually sharp-pointed cladi; shaft up to about 4·5 by 0·025 mm., with cladi 0·12 by 0·017 mm.

(3) Promesotriænes (plagiomesotriænes) (figs. 10–10 *d*); with three wide-spread cladi turned forwards towards the tips and a fourth ray, shorter than the cladi, which appears as a forward prolongation of the shaft. The cladi are frequently unequal in length and taper gradually to more or less sharply pointed apices. The fourth ray is usually less sharply pointed. Sometimes only two cladi are developed (promesodiænes, fig. 10 *b*). In one specimen I have seen four (promesotetræne, fig. 10 *c*), and in another, the fourth ray, which appears as a prolongation of the shaft, is slightly bifid at the extremity (fig. 10 *d*), the axial canal following the bifurcation. The dimensions of these spicules are about the same as those of the anatriænes and their cladomes occur along with those of the latter in the surface pile, but less abundantly. They are fairly numerous in boiled out preparations and certainly a normal constituent of the spiculation. The inconstancy in the number of the cladi leads me to believe that the promesotriæne owes its origin to meristic variation in the number of primary

* Very rarely one cladus is bifurcate near the tip.

rays of the tetract spicule; one, and usually the only, additional ray being placed in the same straight line as the shaft.

(4) Oxea (fig. 9); long and stout, subfusiform; slightly curved; fairly gradually and sharply pointed at each end; measuring up to about 4·1 by 0·076 mm.; sometimes shorter and stouter.

(5) Oxea (fig. 8); relatively short, slender, fusiform, straight, finely pointed at each end; about 1·2 by 0·017 mm. These are the ectosomal oxea.

(6) Tylasters (fig. 13); with about seven long, slender rays, each ending in a small but distinct knob; without distinct centrum; total diameter up to about 0·01 mm.

(7) Tylospherasters (fig. 14); with large centrum and numerous short, cylindrical rays, each ending in a small knob; total diameter about 0·006 mm.

(8) Microrhabds (figs. 15–15*b*); cylindrical or fusiform, with broadly rounded ends; sometimes centrotylote or irregularly annulate; surface otherwise smooth; about 0·009 by 0·003 mm. Sometimes these spicules show a distinct axial rod, visible both in longitudinal and transverse optical section (figs. 15 *a* and 15 *b*).

There can be no doubt about the close relationship of this sponge to Bowerbank's *Ancorina* (*Ecionemia*) *acervus* [1873 B], which came from Fiji. The spicule categories, with the exception of the promesotriænes, are identical, and the spicules themselves exhibit only minute differences in form. Judging from Bowerbank's description and figures these differences are as follows:—(1) The cladi of the large triænes in his sponge are decidedly longer and more recurved, so that the spicule is an ortho- rather than a plagio-triæne; (2) the rays of the asters are not tylote (but the two kinds of aster are clearly distinguished); (3) the microrhabds are "tuberculated." Bowerbank calls attention to the fact that his sponge exhibits "very nearly the extremes in magnitude of the spicula," referring to the enormous difference in size between the megascleres, which are unusually large, and the microscleres, which are unusually minute. The same holds good with the New Zealand species.

The presence of the promesotriænes serves to distinguish *Ancorina novæ-zealandiæ*, not only from *A. acervus*, but, so far as I am aware, from every other known species of Stellettidæ. This very unusual type of spicule is known, however, in several species of *Geodia*.

Register No., Locality, &c.—X; Station 90, S.W. of Three Kings Islands, New Zealand, 100 fathoms.

17. *Penares tylotaster*, n. sp. (Pl. VII, figs. 16–19.)

The single specimen is massive, with a very irregular, nodular and corrugated surface. A good deal of coarse calcareous débris is included in the sponge, which seems to have lain freely on the sea-bottom. A few conspicuous vents, whose sharp margins lie flush with the general surface, are scattered singly in more or less prominent situations. These vents are subcircular in outline and range up to 3 or 4 mm. in

diameter. They are the openings of well-defined exhalant canals, converging towards them from deep down in the interior of the sponge. The surface (in spirit) is subglabrous, not at all hispid, and distinctly porous in many places. The colour is pale yellowish grey throughout. The texture is firm and rigid. The specimen measures about 75 mm. in maximum horizontal diameter by about 40 mm. in maximum thickness.

Surface sections show the dermal pores to be thickly and evenly distributed all over, and spaced at fairly regular intervals. Each one is circular in outline and about 0·15 mm. in diameter when fully open. There is an ill-defined, collenchymatous cortex about 0·14 mm. thick, densely charged with the characteristic cortical oxea ("microxea"). Beneath this lie large subcortical crypts, into which the dermal pores open directly after penetrating the cortex separately as short cylindrical canals, apparently without sphincters. There may be many such pores in the roof of one of the larger subcortical crypts. In other places the crypts appear to be quite small, possibly with only a single pore opening into each. The flagellate chambers are spherical, and about 0·02 mm. in diameter, with short, wide exhalant canaliculi.

The main skeleton, in the interior of the sponge, is a confused reticulation of large oxea, with a slight tendency to collect into loose bundles radiating towards the surface. Immediately beneath the cortex lie the cladomes of a single layer of dichotriænes, whose rather short shafts are directed contripetally. Outside these comes the cortical skeleton, composed of "microxea" interwoven tangentially in a dense feltwork interrupted only by the dermal pores.

Spicules:—(1) Dichotriænes (Pl. VII, fig. 16); stout, with rather short shaft, tapering gradually to a fairly sharp point; cladi outspread at right angles to shaft, point of bifurcation usually about the middle; secondary cladi conical, fairly sharply pointed, may be irregularly bent and (or) irregularly subdivided towards the apex. In an average specimen the shaft measures about 0·6 by 0·06 mm., with cladome about 0·6 mm. across and primary cladi about as thick as the shaft.

(2) Large oxea (fig. 17); fusiform, slightly curved, gradually and fairly sharply pointed at each end; measuring up to about 1·4 by 0·04 mm., but usually rather less.

(3) "Microxea" (figs. 18, 18a); ranging in size from about 0·034 by 0·004 mm. to about 0·34 by 0·017 mm. The smallest slightly curved, sausage-shaped, bluntly ended, and slightly centrotylote. The largest curved, fusiform, sharply and gradually pointed at each end. Often, instead of being simply curved, the spicule is twice angulated in the same direction. All gradations occur between the extremes, as regards both size and form. These spicules are almost entirely confined to the cortex.

(4) Tylasters (fig. 19); with about ten very slender rays, distinctly tylote, and either a small centrum or none at all. Total diameter about 0·008 to 0·012 mm. These minute asters are very abundant in the walls of the larger canals.

This is a very well-characterised species and forms a notable addition to the few species of *Penares* already described. It is obviously closely related to some

of Mr. Carter's Australian species of "*Stellettinopsis*," viz. *S. coriacea* [1885–6], *S. purpurea* [1886], and *S. lutea* [1886], which have a dermal layer of small oxea and minute, very slender-rayed tylasters, and are apparently epipolasid (lipotriænose) species of *Penares*, possibly all specifically identical.

Register No., Locality, &c. XXVII; 7 miles E. of North Cape, New Zealand, 70 fathoms.

18. *Jaspis novæ-zealandiæ*, n. sp. (Plate VII, figs. 20–23.)

Sponge very irregular in form; flattened, plate-like. The type-specimen (R. N. XXX. 1) forms a strongly curved, slightly fenestrated plate, with a tendency to grow out into short digitiform processes round the margin. There is no distinct evidence as to the mode of attachment. The general surface is coarsely granular and may be roughened by the slight projection of the large oxea. In some places, however, there is a separable, but closely adherent, smooth dermal membrane, bearing quite small, sphinctrate vents. The texture is firm and compact, the colour in spirit pale greyish yellow. This specimen measures about 81 mm. in maximum breadth and the thickness averages about 13 mm.

Two other fragments (R. N. L. 3 and L. 6), possibly of one specimen, came from a different station and differ from the type in their dark blackish grey colour. The small, sphinctrate vents, grouped in concave parts of the surface, are very distinct.

There is no distinct cortex, and the boundary between ectosome and choanosome cannot be made out even in stained preparations.

The main skeleton is a confused reticulation of large, stout oxea, extending right up to the surface, where there is a dermal, or better, subdermal crust of spherasters, varying greatly in thickness and density.

Spicules:—(1) Oxea (Pl. VII, fig. 20); fusiform, rather strongly curved, very stout, tapering gradually and symmetrically to a fairly sharp point at each end; size about 2·0 by 0·1 mm.

(2) Spherasters (fig. 21); with well-developed centrum and about a dozen short, stout, conical rays, often slightly roughened; total diameter about 0·016 mm. Characteristic of the dermal crust, decreasing to a minimum in the deeper parts of the sponge.

(3) Oxyasters (fig. 22); with few, long, slender, sharply pointed, slightly roughened rays and little or no centrum; total diameter about 0·032 mm. Characteristic of the interior.

(4) Small spherasters (fig. 23); with small centrum and about a dozen (or perhaps more) short, slender, cylindrical rays; total diameter about 0·012 mm. Characteristic of the zone beneath the dermal crust and in the sphincter membranes of the vents. Not very numerous, possibly young forms of (2).

In the possession of well-distinguished spherasters and oxyasters this species

resembles *Jaspis* (*Dorypleres*) *dendyi*, Sollas [1888] and *Jaspis* (*Coppatias*) *distinctus*, Thiele [1900], but appears to be quite distinct from both.

Register Nos., Localities, &c.—XXX. 1, Station 144, near Cape Maria van Diemen, 35–40 fathoms; L. 3, 6, Station 134, Spirits Bay, near North Cape, 11–20 fathoms. New Zealand.

19. *Asteropus simplex* (Carter).

Stellettinopsis simplex, Carter [1879, 1885–6]; *Asteropus simplex*, Sollas [1888]; *Asteropus haeckeli*, Dendy [1905]; *Asteropus simplex*, Hentschel [1909]; *Asteropus simplex*, Dendy [1916 A, B].

There is one specimen of this variable and widely distributed species in the collection, which presents some features of interest. It consists of two stout, digitiform processes, united below and torn off from the base. The larger of the two attains a height of 105 mm. and a maximum diameter of 46 mm. The smaller is about half as high. Both are somewhat compressed, and the breadth of the entire specimen below their junction is about 52 mm. The oscula are rather small and mostly situate about the two apices of the sponge. With the exception of a larger or smaller area at each apex, including the vents, and a very small area including a single vent on one side, the entire surface is encrusted with *Desmacella vestibularis*. Where exposed the surface is dark brown in colour, slightly and minutely conulose, and glabrous; covered by a distinct, thin, dermal membrane perforated by numerous scattered inhalant pores.

There is a strongly developed ectosome, about 1 mm. or more in thickness, mostly non-fibrous, but with a slight admixture of fibrous tissue. Scattered throughout the ectosome are very numerous large, oval, vesicular cells containing a dark brown pigment in the form of very well-defined, coarse granules, subspherical in shape. The cells themselves measure about 0·44 mm. in longer diameter and the granules about 0·004 mm. In addition to these pigment-containing cells there are even more numerous cystenchyme cells of about the same shape and size, with faintly staining, reticulate and finely granular contents, and very small, darkly staining nucleus, suspended in the middle of the cytoplasmic network. The pigment cells appear to be merely cystenchyme cells in which pigment granules have made their appearance. The entire ectosome should perhaps be described as cystenchymatous rather than collenchymatous.

The skeleton is a confused reticulation of large oxea, continued into the *Desmacella* layer.

Spicules:—(1) Large, stout, fusiform, slightly curved oxea; about 2·5 by 0·068 mm.

(2) Oxyasters; with comparatively few, long, slender, sharply pointed rays, very slightly roughened, and no centrum; total diameter about 0·04 mm.; or with more numerous and shorter rays and perhaps a small centrum. Very numerous in the choanosome.

(3) Sanidasters ; about 0·02 mm. long ; very numerous in the dermal membrane.

In boiled out preparations of the spicules I have found a very few triænes and triæne-derivatives, viz. one plagiotriæne, one mesotriæne and one curious hexact form. All these seem to belong to the sponge, but they cannot be regarded as normal constituents of the spiculation. I regard them merely as vestigial occurrences pointing to the derivation of the species from some triæne-bearing ancestor. It will be remembered that Sollas [1888, p. 201] records the occurrence of triænes, overlooked by Carter, in *Stellettinopsis* (*Algol*) *corticata*. The problem of the generic nomenclature of these species is very difficult. They seem undoubtedly to be reduced Ancorinas and might perhaps be included in that genus.

Hentschel [1909] notes that some of his specimens of this sponge from S.W. Australia were completely covered, except in the neighbourhood of the vents, with crusts of *Hymedesmia lophastræa*, which seems to play exactly the same part as the *Desmacella* in the New Zealand specimen. Hentschel suggests the possibility of a regular "Symbiosis" between the two sponges ; "Commensalism" would probably be a better term (*vide* under *Desmacella vestibularis*).

Previously known Distribution.—South-West Australia (Carter, Hentschel) ; Victoria, Australia (Carter) ; Indian Ocean (Ceylon, Okhamandal, Cargados Carajos) (Dendy) ; Hayti (Carter).

Register No., Locality, &c.—XXXII. 11 ; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

20. *Spongosorites novæ-zealandiæ*, n. sp.

There are in the collection two specimens of this species, closely resembling one another. Each is, on the whole, cylindrical in form, with a curious rolled appearance, and is penetrated by one or more longitudinal canals, about 3 mm. in diameter. These canals open terminally, on the truncated end of the sponge, and they lie for the most part just beneath the surface, where their course is marked by shallow grooves. Other grooves, ramifying on the surface, correspond to subsidiary canals. One of the two specimens is fenestrated, as if a branch had been given off and then joined up again, and it seems quite possible that the main longitudinal canals are formed by a process of folding or overgrowth. The surface is almost smooth, but in places where it has been protected from friction it tends to become hispid. One specimen measures 52 mm. in length by 17 mm. in maximum diameter. The other is shorter and thicker, about 20 mm. in diameter. The colour in spirit is light yellowish grey ; the texture hard, compact, and almost incompressible. The specimens appear to have lain freely on the sea-bottom.

The main skeleton is composed of large and small oxea densely felted together. A great many of the large ones are arranged radially, in thick, irregular bundles which terminate at the surface, where their ends are broken off short. Between these bundles is a compact feltwork of both large and small spicules. At the surface

the small oxea are so densely aggregated as to form a spicular cortex about 0·5 mm. thick, in which the spicules have no definite orientation. This cortex, in tangential section, is seen to be pierced by small, round, inhalant apertures, about 0·17 mm. in diameter, arranged in very irregular groups. Vertical sections show that each aperture leads into a narrow chone, which penetrates the cortex and opens into a large subcortical crypt. From these crypts rather wide, radially arranged, inhalant canals extend inwards for a long distance, giving off numerous much smaller branches. It is impossible to make out anything with regard to the form or arrangement of the flagellate chambers. The radial inhalant canals are surrounded by a rather thick layer of collenchyma. There is no fibrous tissue in the cortex.

Spicules:—(1) Large, stout oxea; slightly curved or angulate, occasionally biangulate; gradually, and usually sharply, pointed at each end, rarely blunted at one or both ends. Size variable, up to about 1·6 by 0·048 mm.

(2) Small oxea; similar to (1) but very much smaller and with very few intermediates; size about 0·24 by 0·01 mm.

(3) Very long, slender oxea; slightly bent or crooked; gradually and finely pointed at each end; size about 1·9 by 0·01 mm. These spicules are very much rarer than either of the above, but they seem to be quite characteristic.

This species appears to be quite distinct from any previously referred to the genus Spongosorites. Its characters seem to me rather to support Topsent's view [1900] as to the relationship of the genus to the so-called family Coppatiidæ. I therefore include it amongst the Stellettids.

Register No., Locality, &c.—LIII. *a*, *b*; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

Family GEODIIDÆ.

21. *Geodia regina*, n. sp. (Pl. V, fig. 5; Pl. VIII, figs. 16–22.)

The single specimen (Pl. V, fig. 5) is cup-shaped, but with a very shallow cavity and very broadly rounded margin. It is attached below and on one side to a number of large rock or shell fragments, and bears rather a striking general resemblance to *Stelletta crater* from the same locality. The total height is about 112 mm., and the maximum transverse diameter is about the same, while the depth of the cup-shaped oscular depression is about 20 mm. The surface is smooth and, wherever uninjured, is covered with a finely porous membrane, except, perhaps, round the margin of the cup, between the inhalant and exhalant areas. Where this membrane is rubbed off from the outer surface the inhalant chones are exposed, piercing the cortex, and arranged at very regular intervals of about 2 mm. Removal of the pore-bearing membrane from the cup-shaped depression reveals a similar state of things with regard to the exhalant chones. The texture is hard and incompressible, and the colour in spirit is green owing to the action of the copper of the tank in which the specimen was preserved.

There is, over both inhalant and exhalant areas, a thick cortex (ectosome), differentiated into two chief layers, outer and inner, distinguished from one another by the presence or absence of sterrasters, which are confined to the inner layer. The outer layer is about 0·5 mm. thick, and consists of a gelatinous ground-substance more or less densely charged with subspherical or oval cells, each about 0·024 mm. in diameter, filled with darkly staining, coarsely granular contents. They are probably storage cells or thesocytes. This layer is limited at the surface by the thin, pore-bearing dermal membrane. The inner layer is about 1·7 mm. in thickness (rather thicker over the exhalant area). It is fibrous and densely charged with sterrasters, held together by radially arranged fibres of connective tissue in the well-known fashion. Its deeper part contains the very thick, very densely fibrous sphincters of the chones, inhalant or exhalant.

The inhalant pores, about 0·07 mm. in diameter, are thickly scattered over the outer surface of the sponge, reducing the dermal membrane to a sieve-like net. They lead into irregular subdermal cavities and then wider canals, which unite together to form the great inhalant chones penetrating the layer of sterrasters. These chones, and also the canals in the outer layer of the cortex, are provided with numerous thin, annular diaphragms arranged at frequent intervals. The main sphincters are very strongly developed, 0·5 mm. or more in thickness in the contracted state. They lie in the inner portion of the sterraster layer and form mammiform projections on the roofs of the large subcortical crypts. The latter run radially inwards and give off numerous much narrower, cylindrical, inhalant canals, which ramify through the choanosome. The subcortical crypts and inhalant canals are again abundantly provided with thin, annular diaphragms. The chamber-system is aphodal, with very long excurrent and very short (if any) incurrent canaliculi. The chambers themselves are approximately spherical, about 0·028 mm. in diameter.

The ground-substance between the chambers is finely granular, but around some of the larger canals there is a thick layer of collenchyma.

The exhalant canal-system closely repeats the characters of the inhalant, especially as regards the chones, external cortical canals, and subdermal cavities. The pore-bearing dermal membrane is, however, more delicate, the exhalant pores being larger than the inhalant (about 0·14 mm. in diameter) and the intervening strands of tissue narrower. The sphincters which separate the exhalant chones from the large subcortical crypts resemble exactly those of the inhalant chones.

The arrangement of the skeleton is very typical. In the choanosome are found the usual loose bundles of large oxea, running towards the surface. As they approach the cortex the oxea are replaced by loose brushes of large dichotriænes, whose shafts penetrate the layer of sterrasters, while their cladi are extended in the outer layer of the cortex, beneath the dermal membrane.

The stout shafts of the dichotriænes are often closely accompanied by the very much more slender shafts of protriænes, whose cladi also lie in the outer layer of

the cortex. This layer also contains very numerous short oxea, arranged in close-set radial brushes beneath the surface, with their outer ends projecting very slightly beyond the dermal membrane, while their inner ends reach only about half-way from the surface towards the layer of sterrasters.

Amongst these oxea, at any rate over the outer (inhalant) surface, are found a few very minute anatriænes. Larger anatriænes have been found, accompanying the dicho- and pro-triænes, in the oscular area only.

The dermal membrane and the outer layer of the cortex are densely charged with minute spherasters. Similar minute spherasters are abundantly scattered through the choanosome, together with a much smaller number of relatively large oxyspherasters.

Spicules:—(1) Large, stout dichotriænes (Pl. VIII, fig. 20); shaft somewhat constricted just beneath cladome, tapering very gradually to a rather blunt apex, measuring about 4·6 by 0·1 mm.; cladi stout, with secondaries two or three times as long as primaries, gradually and fairly sharply pointed; total width of cladome about 0·85 mm.

(2) Protriænes (figs. 17–17 *d*); with very long and slender shaft and short, sharply-pointed cladi varying in number. Sometimes the shaft is prolonged to form an additional actine (promesotriæne, fig. 17 *d*). In a fairly well-developed specimen the shaft measures about 4·1 by 0·017 mm. and the cladi about 0·051 by 0·008 mm. In another, in which the cladome is represented only by a single true cladus and a short prolongation of the shaft, the shaft measures about 5·8 by 0·025 mm.; the single cladus about 0·068 by 0·011 mm. and the prolongation of the shaft about 0·051 by 0·008 mm.

(3) Anatriænes (fig. 18); with very long, slender shaft and short, strongly recurved, sharp-pointed cladi. In a typical specimen the shaft measured about 8·0 by 0·02 mm. and the cladi about 0·051 by 0·017 mm. In this specimen the shaft tapered very gradually to a narrow, rounded apex; in another example it was somewhat shorter and terminated, without much diminution, in a distinct knob.

(4) Cortical anatriænes; very minute, with hair-like shaft about 0·4 by 0·004 mm. and cladi similar to those of the larger anatriænes, but only about 0·006 mm. long. Rare, found *in situ* amongst the cortical oxea. Cladome sometimes reduced.

(5) Cortical oxea (fig. 19); short, fusiform, gradually and sharply pointed; measuring about 0·24 by 0·012 mm.

(6) Large oxea (fig. 16); only moderately stout, fusiform, tapering very gradually to a moderately sharp or blunted point at each end, slightly curved; a typical example measures about 4·25 by 0·06 mm.

(7) Sterrasters; perfectly typical, slightly elongated and slightly flattened, with the hilum in the middle of one of the flattened sides; measuring about 0·187 mm. in length by 0·153 mm. in greater transverse diameter.

(8) Oxyspherasters (fig. 21); with large centrum, sometimes very distinct, and numerous rather short, stout, sharply pointed, conical rays, which may be more or less roughened; total diameter when fully grown about 0·048 mm.; much smaller forms, with very slender rays, probably young, also occur.

(9) Minute spherasters (fig. 22); with very short, cylindrical, truncate rays, which may be reduced to mere knobs; total diameter about 0·004 mm.

Register No., Locality, &c.—XXXII. 3; 7 miles E. of North Cape, New Zealand, 70 fathoms.

22. *Geodia rex*, n. sp. (Pl. VI, fig. 4; Pl. VIII, figs. 23–28.)

Sponge (Pl. VI, fig. 4) cup-shaped, but with shallow cavity and broadly rounded margin; attached irregularly to rock-fragments. Resembling in general features *Geodia regina*, but more turbinate and much larger. The larger of the two specimens is about 190 mm. in height, with a maximum diameter across the top of 255 mm., the greatest depth of the cavity, which is very irregular, being about 50 mm. The smaller one is not very much less. The greater part of the surface is fairly smooth and not hispid, but in the larger specimen there are several patches of thick fur, formed by the projection of long spicules, as shown in the figure. Both specimens have been dried, and are now of a light brown colour, and very hard and incompressible owing to the very strongly developed cortex. Internally the sponge is of a much darker brown colour and very cavernous, owing chiefly to the drying up of the mesoglœa.

Although it is not possible to make out details of the anatomy it is evident that the canal-system is arranged as in *Geodia regina*, both surfaces being covered with a thin, pore-bearing dermal membrane. Beneath this lies the very strongly developed cortex, in which the layer of sterrasters is about 6 mm. thick, while the outer layer, containing the cladomes of the orthotriænes, is hardly distinguishable in the dry material.

The skeleton arrangement is typical. When the sponge is sawn across the usual loose bundles of large oxea are seen radiating outwards at right angles to the surface and connected at frequent intervals by transverse spicules or spicule-bundles, or by spicules quite irregularly arranged. The outer ends of the radiating bundles pierce the layer of sterrasters and the cladomes of the orthotriænes are extended beneath the dermal membrane. The radiating brushes of small oxea in the outer layer of the cortex are very well developed.

The following account of the spiculation is taken from the smaller of the two specimens (R. N. XXXIII. 8).

Spicules:—(1) Orthotriænes (Pl. VIII, fig. 23); shaft long and comparatively slender, tapering gradually to a bluntly rounded apex; cladi well developed, straight or slightly curved, tapering gradually to blunt apices, apparently never bifurcating. In a typical example the shaft measures about 10·0 by 0·1 mm., with cladi 0·63 by

0·085 mm. (A note by Mr. Row records an orthotriæne 20·5 mm. in length, but I cannot confirm this.)

(2) Anatriænes (fig. 25); with very long, slender shaft, tapering very gradually to a more or less blunted apex and sinuous in boiled out preparations, and strongly recurved, sharply conical cladi. In a typical example the shaft measures about 17·0 mm. in length by 0·04 mm. at the thickest, with cladi about 0·14 mm. long. (A note by Mr. Row records an anatriæne up to 29 mm. in length, with the point broken off, but I cannot confirm this.)

(3) Cortical oxea; measuring about 0·6 by 0·017 mm.

(4) Large oxea (fig. 24); straight or nearly so; apparently never sharply pointed, and often so broadly rounded off at the ends as to become strongylote; tapering gradually from the middle to the extremities; a typical example measures about 9·3 by 0·093 mm.

(5) Sterrasters (fig. 26); very large, usually oval and somewhat flattened, with the hilum in the middle of one of the flattened surfaces; measuring about 0·48 mm. in length by 0·4 mm. in greater transverse diameter.

(6) Larger oxyspherasters (fig. 27); with more or less well-developed centrum and numerous slender rays tapering gradually to sharp points; smooth or nearly so; measuring up to 0·02 mm. in total diameter.

(7) Smaller oxyspherasters or oxyasters (fig. 28); with short rays which may be very slightly roughened, and may be blunted; total diameter about 0·01 mm.; characteristic of the dermal membrane.

This remarkable species bears a considerable resemblance to *Geodia regina*, but differs in several important respects, the chief of which is perhaps the replacement of the dichotriæne of the former by a simple orthotriæne. Apparently, also, there are no protriænes and no small, cortical anatriænes, but this is a difference upon which it would not be wise to insist, as such spicules may be found later on in more favourable material. The sterrasters are more than twice as long and as broad as in *G. regina* and are perhaps the largest known, and the size of the sponge and thickness of the cortex are very remarkable.

Geodia rex is perhaps more closely related to *G.* (*Cydonium*) *japonica*, Sollas [1888], re-described, with good illustrations, by Thiele [1898]. It differs, however, in important particulars, especially in the enormous size of the large oxea, the orthotriænes, and the sterrasters, although some of the specimens of *Geodia japonica* seem to have been at least as large as ours of *G. rex*. There also seem to be considerable differences in the smaller asters, and the cortex of *G. rex* appears to be nearly eight times as thick as that of *G. japonica*, in which also the outer surface is characteristically nodulated.

Register Nos., Locality, &c.—XXXIII. 4, 8; off Three Kings Islands (or off North Cape ?), N. of New Zealand.

Genus Geodinella, Lendenfeld [1903].

Geodiidæ with a cortical layer of sterrasters, but with the cladi of the triænes more or less reduced to vestiges, or even absent, so that the triæne may become a style.

Lendenfeld's original diagnosis mainly emphasises the fact that the triænes lie in the interior, arranged in longitudinal bundles and forming an axial skeleton. There is no such axial skeleton in the species described below, and the chief distinguishing feature of the genus seems to be the reduction of the triænes; this is recognised by Lendenfeld in the new diagnosis given in the "Albatross" Report [1910].

So far as I am aware only two other species of *Geodinella* have been described, viz. Thiele's *G. cylindrica* [1898] from Japan, and Lendenfeld's *G. robusta* [1910] from the north-eastern Pacific (west coast of North America). All three species agree in the curious reduction of the cladomes of the triænes and form an interesting parallel to the case of my *Stelletta vestigium* from Ceylon [Dendy, 1905].

It is a matter of considerable doubt whether or not such a character should be regarded as of generic significance, but the existence of three species all sharing this peculiarity renders it convenient to retain the genus for the present.

23. *Geodinella vestigifera*, n.sp. (Pl. VIII, figs. 29–37.)

The single specimen is irregularly tuberous, broken off at one end; now about 40 mm. long by 20 mm. in maximum diameter. It has evidently been attached below to some foreign object. The surface is smooth, without any hispidation, but is partially encrusted by foreign growths. A few minute apertures, about 0·5 mm. in diameter, are scattered singly, here and there. Though very small, these are very well defined, and probably represent the openings of exhalant chones. The upper surface is light brown, shading to pale yellow below. The texture is hard and incompressible, owing to the very strongly developed cortex.

So far as can be made out, the canal-system is typical, with finely granular mesoglœa between the chambers.

The entire cortex is occupied by the layer of sterrasters, about 0·85 mm. thick, covered over only by a thin dermal membrane charged with minute spherasters. The skeleton of the choanosome is extremely lax and confused, with a few very loose bands of megascleres running towards the cortex, but not penetrating it. There is no axial core of spicular fibre.

Spicules.—(1) Reduced triænes, for the most part represented by styli (figs. 29 and 29 *a*), with broadly rounded base usually directed outwards in the radial spicule-bundles, and tapering gradually from the base to the narrow apex, the extreme point of which, however, is usually rounded off. These spicules are usually slightly curved or bent, and a well-developed example measures about 1·4 by 0·025 mm. The triænal origin of these spicules is indicated (*a*) by their position and orientation

in the sponge, and (*b*) by the occasional (but rather rare) occurrence of a vestigial cladus on the base (figs. 30 and 30 *a*).

Certain abnormal forms (figs. 30, *b–d*), which look as if they had been produced by the grafting of one or more, usually long, rays on to the end of a style, are about as common as the reduced triænes. It is possible that we have here an illustration of the variability of vestigial structures, but the rays in question do not suggest vestiges so much as newly arisen monstrosities due to the activity of abnormally situated "initial cells."

A very few normal and well-developed anatriænes have been observed, of rather large size, these may be proper to the sponge or they may possibly be foreign.

(2) Long, slender oxea (fig. 33); tapering gradually to the two extremities; variously ended (gradually sharp-pointed, hastate, rounded off or irregular), measuring up to about 1·9 by 0·02 mm. Much more numerous than the styli.

(3) Gigantic, fusiform oxea (fig. 32); very stout, and tapering gradually to a sharp point at each end; measuring about 2·0 by 0·12 mm. Very scarce in comparison with the other megascleres, but probably normal; variously orientated in the choanosome.

(4) Short, curved oxea (fig. 31); fairly stout, gradually and fairly sharply pointed at each end; measuring about 0·48 by 0·017 mm.; scattered rather sparsely in the choanosome.

(5) Sterrasters; of quite ordinary form, elliptical and slightly flattened; measuring about 0·14 by 0·12 mm.

(6) Large oxyasters (fig. 34); with usually about nine rather slender rays, roughened distally, and no distinct centrum. Total diameter up to about 0·064 mm. The rays may be as few as five, and are usually more slender than represented in fig. 34. Found in the choanosome.

(7) Small oxyasters (fig. 35); with numerous smooth or nearly smooth rays; possibly young forms.

(8) Small strongylasters (fig. 36); with no distinct centrum and numerous slender, cylindrical, slightly roughened rays; total diameter up to about 0·024 mm. Choanosomal.

(9) Minute strongylospherasters (fig. 37); with large centrum and numerous short, blunt, cylindrical rays sharply differentiated from it; total diameter up to about 0·012 mm., often less. Thickly crowded in the dermal membrane.

Register No., Locality, &c.—L. 8; Station 134, Spirits Bay, near North Cape, New Zealand, 11–20 fathoms.

Family CHONDROSIIDÆ.

24. *Chondrilla nucula*, O. Schmidt [1862].

A single specimen of this widely distributed and well-known species was collected on the shore between tide-marks at the Island of South Trinidad. It forms a flat

and rather thin crust, attached to rock, with small, scattered vents on the surface. The colour in spirit is pale yellowish brown. The spherasters are few, and up to about 0·028 mm. in diameter.

Previously known Distribution.—Almost cosmopolitan.

Register No., Locality, &c.—VIII; Island of South Trinidad, July 26th, 1910.

Sub-order SIGMATOTETRAXONIDA.

Family LITHISTIDÆ.

25. *Aciculites pulchra*, n. sp. (Pl. VI, figs. 1 and 1 *a*.)

There are in the collection two good specimens of this sponge in an excellent state of preservation. One of them (LVI. *a*) is complete, and consists of an ear-shaped lamella, slightly curved, and with broadly rounded margin. It has evidently been attached along one edge, which is very irregular, and to which numerous foreign bodies still adhere. The two surfaces are sharply differentiated, the one, which happens in this case to be convex, bears the numerous minute oscula; the other no doubt bears the much more numerous and more minute inhalant pores, which are apparently all closed. This specimen measures about 47 mm. in height, from the middle of the line of attachment to the margin, by about 69 mm. in breadth, along the line of attachment, and 11 mm. in thickness.

The second specimen is in two pieces (LVI. *b*, *c*). It is a good deal larger, but rather thinner and more fan-like in shape (Pl. VI, figs. 1 and 1 *a*). It measures about 118 mm. in breadth by 8 mm. in thickness, and 96 mm. in height, but the attachment is nearly all broken away. The lamella of which the sponge consists undulates somewhat, but on the whole the exhalant surface appears to be rather more concave than the inhalant. The numerous small vents are more or less stellate in appearance, and situate on very low protuberances. They are nearly all closed now by a thin, translucent membrane, which may be visibly perforated in the middle, and when this is removed a group of three or four minute apertures is revealed. The vents, or groups of vents, are separated by intervals of only about 2 mm. in width, in which can be seen a meandriniform pattern caused by narrow, superficial, exhalant canals, ramifying beneath the thin dermal membrane. The inhalant surface (in this specimen only) shows rather faintly marked concentric furrows, evidently lines of growth. In this larger specimen narrow, meandering, superficial inhalant canals can be seen through the dermal membrane; they are hardly recognisable in the smaller one, which, except as indicated, agrees closely on both surfaces.

The colour in spirit is very light yellowish brown; the texture is compact and very stony.

The main skeleton is a very dense reticulation of monocrepid desmas, with a few scattered rhabdi (strongyla), for the most part radially arranged. The great majority of the rhabdi, however, form a dermal or subdermal skeleton, and the arrangement of this is very different on the two surfaces. On the inhalant surface

there are only radially arranged rhabdi with slightly projecting ends, springing from a well-defined layer of apparently young desmas, which are more slender and less complex in their branching than the deeper desmas. On the exhalant surface there is a layer of more or less closely interwoven rhabdi, arranged tangentially, and forming tent-like projections over the vents, as described by Sollas for *Aciculites higginsii*. Beneath this layer isolated young desmas are to be found, but there is no such definite reticulation of slenderer desmas as occurs beneath the inhalant surface. The layer of tangentially arranged rhabdi is continued over the broadly rounded margin, showing that this really belongs to the exhalant surface.

Spicules :—(1) Desmas; monocrepid; much branched, and more or less richly tuberculated, especially at the ends, where they interlock; tubercles conical and rather sharp; maximum length in a straight line about 0·34 mm.

(2) Rhabdi; strongylote, slightly curved, approximately equal-ended, or with one end rather thicker than the other, or even slightly tylote; one or both ends may be minutely spined; length about 0·34 by 0·012 mm.

The spicules agree so closely with those of my *Aciculites orientalis*, figured in the Report on the Ceylon Sponges [1905], that it is unnecessary to give illustrations.

The New Zealand species differs from both *A. higginsii*, Schmidt [1879] (the type of the genus) and *A. orientalis*, Dendy [1905], which are probably specifically identical with one another, in its very definite and beautiful flabellate form.

Register Nos., Locality, &c.—LVI. *a*, *b* + *c*; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

Genus LEPIDOSPONGIA, n. gen.

Sponge thinly encrusting. Desmas absent. Skeleton consisting of an upper and a lower layer of scale-like discotriænes or discs, with the choanosome between. Microrhabds present.

This remarkable genus evidently represents a reduction stage in the phylogeny of the Theonellidæ. However paradoxical it may seem to include a genus without desmas amongst the lithistid sponges, the relationship is quite obvious, and the case forms an interesting parallel to that of the lipotriænose Stellettidæ and the lipochelous Desmacidonidæ.

Topsent [1920] has shown that the larva of the curious boring sponge, *Alectona millari*, which in the adult condition possesses only pseudastrose microscleres and no megascleres, is provided with a cuirass of eight discotriænes symmetrically arranged and indistinguishable from those of *Discodermia*. There appears, therefore, to be no doubt of the theonellid ancestry of *Alectona*, and we have here a most beautiful instance of recapitulation. The new genus *Lepidospongia* may be regarded as representing an intermediate condition, in which the sponge has lost the desmas but still retains the discotriænes in the adult condition. It is interesting to observe how the reduction in spiculation is accompanied by change in habit, from the massive, through the thinly encrusting, to the boring condition. The genus *Cliona* appears to

have been similarly derived by change of habit from a spirastrelline ancestry, and its resemblance to *Alectona* seems to be due entirely to convergence.

Thoosa armata is another boring sponge which has been shown by Topsent [1903] to possess a cuirass of discs in the larval state, but the discs in this case appear to be monaxonid (probably diact), having a single straight axial canal; we have here very probably another case of convergence. All these cases seem to me to point to the polyphyletic origin of the boring sponges.

26. *Lepidospongia incrustans*, n. sp. (Pl. XIII, figs. 1–3.)

The sponge forms a thin crust spreading over the smooth but uneven surface of a small block of basalt, in company with numerous other organisms. It covers an irregular area, measuring about 19 by 10 mm., and has been partially rubbed off. As the specimen has been dried it is not possible to give a very satisfactory account of its structure, which would in any case be difficult owing to the thinly encrusting habit. The sponge consists now of two thin layers of overlapping, scale-like discs, separated (where intact) by an almost equally thin layer of dark brown, shrunken tissue. The lower layer of discs adheres closely to the surface of the stone, remaining behind when the upper layer has been rubbed off. The upper layer, forming the surface of the sponge, has a beautiful, silvery, scaly appearance under a pocket-lens, and is interrupted by fairly numerous minute apertures, each raised on a very slight, conical elevation.

There are no desmas, the skeleton consisting almost exclusively of the two layers of scale-like discs, or discotriænes; together with numerous microrhabds, congregated especially around the openings of the canal-system.

Spicules:—(1) Discotriænes (discs) (Pl. XIII, figs. 1 and 2). These are nearly all completely reduced to the thin, flat, disc-like cladome, without any trace of shaft; but a few still have a stout, well-developed shaft. The outline of the disc varies a good deal, but is seldom deeply indented, and may perhaps be described as approximately circular or oval. Some of the discs exhibit a reticulate sculpture, as shown in fig. 2, others appear to be perfectly smooth and structureless, showing no trace even of the axial canals. The diameter of the fully developed disc is about 0·25 mm.

(2) Microrhabds (fig. 3); fusiform, bluntly pointed, straight or slightly angulated in the middle, or slightly centrotylote; surface usually slightly roughened; size about 0·02 by 0·002 mm.

A few slender, rod-like megascleres, probably oxea or styli, are associated in a common bundle with each of the few remaining shafts of the discotriænes. The close association may be partly due to the drying of the sponge. In any case, these spicules can hardly be regarded as more than vestigial. They should be compared with the transient styles described by Topsent in the larva of Alectona [1920].

Register No., Locality, &c.—XXXV. *m*; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

Family TETILLIDÆ.

27. *Craniella zetlandica* (Carter).

Tethya zetlandica, Carter [1872]; *Tethea simillima*, Bowerbank [1873 A]; *Tethya cranium*, var. 2, *zetlandica*, Norman [1882]; *Craniella Bowerbankii*, Sollas [1886]; *Craniella simillima*, Sollas [1888]; *Craniella zetlandica*, Sollas [1888]; *Tethyopsilla zetlandica*, Lendenfeld [1903]; *Craniella cranium, pars*, Topsent [1904]; *Tethyopsilla zetlandica*, Hentschel [1912]. (For other possible synonyms see Lendenfeld [1903].)

There is in the collection a single very typical example of this species. It is almost spherical in form, about 24 mm. in maximum diameter, and has a strongly hispid surface. There is a single small vent, situated on a slight conical projection. The colour in spirit is dirty white. I follow Carter, Sollas and Lendenfeld in regarding the absence of sigmata as a sufficient justification for separating this species from *C. cranium*, though there is a great deal to be said for the opposite view maintained by Topsent. The two forms are evidently most closely related, and illustrate very well the impracticability of maintaining Lendenfeld's genus *Tethyopsilla* for the asigmatose Tetillids. The case is quite parallel to that of the lipochelous Desmacidonidæ.

Previously known Distribution.—Various localities in the Atlantic, Indian and Pacific Oceans.

Register No., Locality, &c.—XXXVIII; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

28. *Cinachyra uteoides*, n. sp. (Pl. X, fig. 4.)

The single specimen (Pl. X, fig. 4) is pear-shaped, broadly rounded above, but with a truncated base which seems to have been lightly attached to a sandy substratum. About twenty small conical projections are scattered irregularly over the surface, more numerous in the upper than in the lower half of the sponge. These bear the openings of porocalyces in various states of contraction. When fully expanded the opening is wide (about 1 mm. in diameter) and the porocalyx is seen to be deeply cup-shaped. Sometimes the opening is blocked up by a gelatinous substance which may take the form of a sphincter. The projection bearing the porocalyx appears more or less conical or truncated according to the state of contraction of the opening. It is impossible, without injuring the sponge to an unjustifiable extent, to distinguish between the inhalant and the exhalant porocalyces, but I suspect that those on the broadly rounded summit of the sponge, which appear more conical than the remainder, are exhalant.* The surface of the sponge is not hispid, but between the porocalyces it is slightly corrugated and has a characteristic striated appearance under a lens, due to the paratangentially arranged cortical oxea. The height of the specimen is 26 mm.; the greatest transverse diameter about the same; the diameter of the truncated base about 15 mm. The

* I do not think they are simple oscula, but the possibility of this must not be lost sight of; in their closed condition it is very difficult to make sure.

conuli which bear the porocalyces attain a height of little more than 1 mm. The colour in spirit is very pale yellow, nearly white on the surface; the texture compact but rather yielding.

Stained sections demonstrate the existence of a thin cortex (about 0·34 mm. thick), fibrous in its inner portion. The walls of the porocalyces possess a very distinct fibrous layer, and in life are doubtless pierced by a very large number of pores, no longer distinctly recognisable. These sections also show that the gelatinous material which more or less blocks up so many of the porocalyces is really not part of the sponge-tissues, though it may be formed as a secretion. Nothing can be made out as to the structure and arrangement of the flagellate chambers, but it is worth noting that the choanosome is densely crowded with large, spherical, coarsely granular cells, about 0·012 mm. in diameter, which seem to be especially concentrated around the larger canals.

The main skeleton consists, in the first place, of rather slender bundles of long slender oxea and anatriænes, radiating from the interior of the sponge and ending at the surface after penetrating the cortex. The cladomes of the anatriænes echinate these bundles in groups, and the last group seems to lie just outside the cortex. Possibly some of the "grapnels" projected for some distance beyond the surface in the living sponge. Many of the shorter and stouter oxea occur irregularly scattered between the radiating bundles, but these spicules are especially abundant in the cortex, where they are arranged paratangentially in a dense layer. In this layer many spicules lie parallel to one another, forming different sets crossing one another at various angles.

An interesting feature of the skeleton is the presence of slender bundles of hair-like protriænes (trichotriænes) whose terminal ramifications hispidate the lining membrane of the porocalyces, as in several other species of *Cinachyra* [Dendy, 1921, p. 12]. Ordinary protriænes, of large size, occur in radial bundles in the conuli, associated with oxea. There is a ring of such bundles around each porocalyx, parallel with its long axis, their ends fringing the margin of the porocalyx, but now nearly all broken off. The bundles of trichotriænes seem to branch out from these very much stouter bundles towards the lining membrane of the porocalyx.

Spicules:—(1) Large protriænes; the cladi are equal or unequal, usually all three well developed, straight or nearly so, and gradually sharp-pointed; the shaft is at first fairly stout, then increases somewhat, and tapers very gradually to a very fine, long, hair-like terminal portion; it is almost invariably broken short in boiled out preparations, so that it is impossible to give the maximum length. In a large specimen the three cladi measured each about 0·14 by 0·011 mm. and the remaining portion of the shaft 6·3 by 0·025 mm., being stoutest at a considerable distance below the cladome; the hair-like terminal portion of the shaft, however, was broken off, and this may have measured another 2 mm. in length at least.

(2) Trichotriænes; resembling (1) but of very much smaller size, in fact of

hair-like dimensions throughout. These remain together in bundles in boiled out preparations and cannot be separately measured.

(3) Anatriænes; remarkable for the flatness of the curve of the cladome, the cladi coming off from the shaft almost at right angles, but slightly recurved, especially towards the apex. Another characteristic feature is the rapid narrowing of the shaft for a short distance below the cladome, after which it passes gradually into the very long-drawn-out, hair-like extremity. In a typical example the cladome measures about 0·12 mm. across and the cladi and shaft are all about 0·017 mm. in diameter at their origin, while the shaft is about 2·5 mm. long.

(4) Long, slender, straight, fusiform oxea; tapering very gradually from the middle to each sharply pointed extremity. A typical example measures about 4·3 by 0·05 mm. These are the characteristic oxea of the main skeletal bundles.

(5) Stout, curved, fusiform oxea; symmetrical; gradually and more or less sharply pointed at each end; varying greatly in size, up to about 2·6 by 0·08 mm., but usually smaller. The larger examples of these spicules occur irregularly and abundantly scattered through the choanosome. Smaller ones, placed paratangentially, form the characteristic cortical layer, but even here there is a small admixture of larger forms, just as there is some admixture of smaller forms in the interior.

(6) Sigmata; very slender, C and S-shaped; of the usual tetillid form; measuring about 0·012 mm. from bend to bend.

I have given a key to all the known species of *Cinachyra* in my report on the Sigmatotetraxonida of the "Sealark" Expedition [1921], from which it will be seen that the sponge described above differs conspicuously from any previously known species of the genus in the presence of the cortical layer of *paratangentially* disposed oxea. This gives to the surface of the sponge a characteristic striated appearance, and has suggested the specific name *uteoides*.

Register No., Locality, &c.—XLII; Station 90, off Three Kings Islands, New Zealand, 100 fathoms.

Family HAPLOSCLERIDÆ.

Sub-family GELLIINÆ.

29. *Gellius flagellifer*, Ridley and Dendy.

(For literature and synonymy *vide* Dendy [1921].)

This widely distributed species is represented by a small and very thin crust attached to the block of black basalt, R. N. XXXV. The spiculation differs from that of the type of the species chiefly in the smaller size of the oxea. These measure only about 0·21 by 0·008 mm.; the flagelliform sigmata about 0·064 mm. and the small, ordinary sigmata about 0·028 mm. in longest diameter from curve to curve.

Previously known Distribution.—Off Marion Island (Ridley and Dendy); Davis

Strait (Fristedt); Atlantic coast of Canada (Lambe); Gulf of Gascoyne (Topsent); Iceland (Lundbeck); Saya de Malha, Indian Ocean (Dendy).

Register No., Locality, &c.—XXXV. *y*; Station 90, near Three Kings Islands, N. of new Zealand, 100 fathoms.

30. *Gellius petrocalyx*, n. sp. (Plate VI. figs. 2 and 3.)

There are two specimens of this remarkable species in the collection, of which R. N. XXXII. 9 may be regarded as the type. This specimen (Pl. VI, fig. 3) forms an irregular, thick-walled cup, deeply funnel-shaped but truncated below, where it has apparently been attached, and with unevenly undulating margin. The inner surface bears numerous conspicuous vents, varying in diameter up to about 3 mm. These vents have sharply defined margins, flush with the general surface; each is the opening of a basin-shaped depression into which a group of exhalant canals discharge. They are scattered fairly uniformly over the whole of the inner surface, at intervals of usually not more than 5 mm. The outer surface, on the whole, is smooth, but has a worm-eaten appearance which may be due to rubbing off of the dermal membrane. The maximum height of the specimen is about 105 mm.; the greatest breadth of the cup, which is somewhat compressed, is 136 mm.; the thickness of the wall, half-way up, is about 21 mm., thinning out to the margin. The colour in spirit, now, is greenish grey.* The texture is compact, hard, and stony, like that of a Lithistid.

The second specimen (R. N. XXXII. 1, fig. 2) is of about the same size and the same general appearance, but fan-shaped and with a more even margin, the funnel being widely incomplete on one side, owing perhaps to the presence of a couple of solitary corals, one standing on top of the other, partially embedded in the sponge-wall. In this specimen also the vents (on the inner surface of the cup as before) are much less numerous and less conspicuous, evidently because the rather thick, and in this case easily separable, dermal layer has largely peeled off. The compact stony texture is just the same as in the other specimen.

The main skeleton is an extremely dense, sub-isodictyal network of single oxea, and there seem to be no fibres and no spongin, so that, in spite of its stony character, the sponge can easily be rubbed to powder between the fingers. There is a more or less readily separable dermal membrane in which the spicules lie tangentially, again forming a close network.

Spicules:—(1) Oxea; rather stout, more or less strongly curved, very sharply and fairly gradually pointed at each end; measuring about 0·184 by 0·012 mm.

(2) Sigmata; very slender, fairly symmetrically C-shaped; sometimes with a slight indication of angulation in the middle; varying greatly in size, up to about 0·03 mm. from bend to bend; sometimes rather larger in R. N. XXXII. 1.

(3) Toxa; very few, small; rather more abundant in R. N. XXXII. 1.

* The green tint is due to staining by the copper of the tank in which the sponge was preserved.

This species is sharply distinguished by its stony texture and characteristic external form, but there is nothing peculiar about its spiculation.

Register Nos., Locality, &c.—XXXII. 1, 9; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

31. *Gellius imperialis*, n. sp. (Plate IX, fig. 1.)

There are in the collection a large number of fragments of this remarkable and very beautiful sponge. All the larger pieces have been dried, but a few small bits have been preserved in spirit. So much of the sponge as can be safely reconstructed is represented in Pl. IX, fig. 1, which represents the two largest pieces put together, with the addition of a number of marginal fragments. Some large fragments remain over, and it is doubtful whether they could all have come from the same specimen. Evidently the sponge was "bivalvate," consisting of two thin, fan-shaped lamellæ diverging slightly from the end of a short, thick stalk. The outer surface of each valve is buttressed by two or three prominent ribs continued from the stalk, each rib bearing a row of marginal vents; while a little irregular ribbing, or rugosity, without vents, occurs elsewhere. The outer (or inhalant) surface, except for these rugosities, is smooth and covered by a thin, pore-bearing dermal membrane. The same is true of *both* surfaces of the prominent ribs. The inner surface is smooth, but exhibits a curious pock-marked appearance towards the margin, and may also be curiously marked by concentric lines of growth. It is everywhere perforated by close-set, minute openings, usually not more than 0·5 mm. in diameter, frequently less; these are the openings of narrow canals which penetrate the lamella at right angles and seem usually to run right through to the pore-bearing dermal membrane on the other side. Opposite the prominent ribs are rows of larger openings, up to 3 mm. in diameter, which lead into (oscular ?) tubes which run through the ribs and open at their other ends as the large marginal vents, of about the same diameter. The margins of the lamellæ themselves are very thin and bear no vents. The height of the specimen, as restored, is about 380 mm., of which about 30 mm. is stalk, and the horizontal breadth is about the same. The thickness of the lamella in the middle is only about 3 mm. The colour, dry and in spirit, is light brown. The texture is fibrous but friable, and the general appearance and consistency of the sponge remind one of thin oat-cake.

The main skeleton is a loose felt-work of coarse spicular fibre running parallel to the two surfaces and concentrated longitudinally in the stalk. The fibres are about 0·25 mm. in diameter and composed of short oxea bound together apparently without any spongin, so that they are very brittle. Between the fibres is an irregular, sometimes unispicular reticulation of oxea. The dermal skeleton differs on the two surfaces of the lamella. On the inhalant (outer) surface it is a rather irregular, unispicular network, in which each side of each mesh is composed of a single spicule. On the exhalant (inner) surface it is a dense, thick felt-work of

interwoven oxea lying paratangentially; forming a sort of spicular cortex about 0·13 mm. thick, pierced by the innumerable small apertures above referred to.

Spicules:—(1) Oxea; short, stout, slightly curved, symmetrical; neither fusiform nor hastate, but sharply and fairly gradually pointed at each end; measuring about 0·24 by 0·016 mm.

(2) Sigmata; very slender, C-shaped, or slightly contort; measuring about 0·02 mm. from bend to bend.

As regards external form the nearest approach to this species known to me is *Cavochalina bilamellata*, as described by Carter [1885–6], from the south coast of Australia. The canal-system should be compared with that of *Phakellia*.*

Register Nos., Locality, &c.—R. N. XXIX; XXXIII. 3, 7, 14, 16, 17; XL; Station 90, off Three Kings Islands, New Zealand, 100 fathoms.

32. *Gellius tubuloramosus*, n. sp.

The single specimen is unfortunately much damaged. It consists of a long, slender, very compact, cylindrical stalk, slightly expanded to form a base of attachment below and bifurcating into two symmetrical branches above. The length of this stalk, to the point of bifurcation, is 92 mm.; the diameter, which is very uniform, about 3·5 mm. Each branch of the stalk continues for about 14 mm. and then begins to expand gradually into a tubular sponge-body. It is these soft and thin-walled tubes that have been so greatly injured. A large part of one of them has been torn away, but most of the other remains. One may assume that each had a wide vent at the summit, as in *Gellius calyx*, but no part of the original margin remains. The more perfect of the two tubes now measures about 95 mm. in length by 18 mm. in diameter, and its wall is barely 2 mm. thick. The two tubes lie parallel with one another, and at one point there is an anastomosis through which their cavities communicate. The outer surface is rather uneven and woolly looking, but there are no projecting spicules to render it hispid, nor is there any distinct dermal membrane. The colour in spirit is pale brown.

In the stem the skeleton consists chiefly of closely packed, dense, longitudinal bundles of oxea, but there is an abundant reticulation of more or less separate spicules between and around these. As the stem expands to form the tubular body its spicule-bundles separate out to form the slender fibres of a sparse reticulation in the body-wall. This is very poorly developed, and in its wide meshes are scattered numerous separate oxea. There appears to be no special dermal skeleton.

Spicules:—(1) Oxea; symmetrical, rather slender, slightly curved or angulated in the middle, gradually and sharply pointed at each end; size about 0·26 by 0·008 to 0·012 mm.

(2) Sigmata; very slender, C-shaped or slightly contort, about 0·024 mm. from bend to bend, abundant.

* *Vide* Dendy [1921, p. 118].

This very interesting species is evidently nearly related to *Gellius calyx*, Ridley and Dendy [1887], obtained by the "Challenger" Expedition off the mouth of the Rio de la Plata at a depth of 600 fathoms, but it differs in its branching habit and its much larger size, while the oxea are much smaller.

Register No., Locality, &c.—XXV; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

Sub-family RENIERINÆ.

33. *Petrosia coralloides*, n. sp. (Pl. XI, figs. 1 and 1 *a*.)

The external appearance of this species is highly characteristic (Pl. XI, figs. 1 and 1 *a*). The sponge forms a rather thin, flattened lamella, extended in apparently the horizontal plane, with a constricted area of attachment, like a very short, thick stalk (with a quantity of débris still adherent), excentrically placed on what is presumably the lower surface. The lamella exhibits a saddle-like curvature, and might be described as forming a very flat cup, with irregular and partially reflected margin and, on the whole, concave upwards. The maximum width of the specimen is about 114 mm.; the thickness of the lamella about 6 mm. The two surfaces are sharply differentiated from one another. The upper (presumably inhalant) is nearly smooth, subglabrous, but at the same time minutely granular, with no openings visible to the naked eye, though in reality covered by a thin, pore-bearing dermal membrane. The lower (presumably exhalant) surface is rather more coarsely granular and is perforated, at fairly close and regular intervals, by very numerous circular apertures, varying up to about 1·5 mm. in diameter,* and separated from one another by intervals of about 2 mm. These apertures are provided with membranous sphincters, some of which are completely closed, others fully open, and the remainder in various stages of contraction. The colour in spirit is dark grey, the texture hard, incompressible, but friable.

The character of the flagellate chambers can no longer be made out, but the general canal-system appears to resemble that of *Phakellia*. Wide canals penetrate the sponge lamina more or less at right angles to its two surfaces, commencing beneath the pore-bearing dermal membrane of the upper surface and terminating at the vents on the lower surface. These canals are to some extent branched, but as a whole they seem to run right through from surface to surface without interruption.† Their upper ends are dilated to form the wide subdermal cavities. Their walls are very ill-defined, and they give off or receive numerous smaller canals along their course. There is some evidence of the occurrence of inhalant pores also on the lower surface, between the vents.

* A very few are larger, up to 2·5 mm. in diameter; the usual diameter is about 1 mm. In the drawing these apertures are hardly represented as sufficiently numerous or as sufficiently definite in outline.

† Compare my observations on the canal-system of *Phakellia conulosa*, var. *mauritiana*, in the "Sealark" Report [1921].

The skeleton is that of a typical *Petrosia*. There appears to be no spongin, and the entire skeleton is a dense network of oxeote megascleres, separate and in bundles. On the upper surface sparse brushes of megascleres stand out at right angles from the outer layer of the main skeleton, their apices just projecting beyond the surface. These brushes support the thin dermal membrane, which has no spicules of its own. On the lower surface there is a subdermal reticulation of stout spicular fibre immediately below the dermal membrane, and dermal brushes are scarcely, if at all, developed.

Spicules:—Oxea; stout, slightly curved, fairly gradually and sharply pointed at each end, measuring about 0·25 by 0·016 mm. Numerous more slender forms also occur, probably young, and there are a good many foreign spicules of various kinds.

The resemblance of this species to the genus *Phakellia* is obvious, but it differs from typical species of that genus in its friable character, due to the absence of spongin, and in the oxeote in place of stylote spicules. The disposition of inhalant and exhalant surfaces appears to be just the reverse of what it usually is in cup-shaped sponges.

Register No., Locality, &c.—XXI; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

34. *Halichondria magellanica*, n. sp.

The single specimen is massive, encrusting and enclosing fragments of coarse black sandstone, and measuring about 62 mm. in maximum diameter. The surface, where uninjured, is smooth and even, covered by a rather thick, finely reticulate dermal layer. The vents appear to be represented by a few small round apertures lying flush with the general surface. The inhalant pores are scattered in the meshes of the dermal reticulation. Internally the sponge is cavernous, crumb-of-bread-like, with wide canals. Texture soft, compressible, friable, but firmer on the surface owing to the well-developed dermal layer. Colour in spirit yellowish grey.

The main skeleton is a very irregular, coarse reticulation of stout, ill-defined, spicular fibres, with numerous loose spicules scattered between. The primary lines run at right angles to the surface and support the dermal membrane. The dermal skeleton is a rather irregular reticulation of coarse spicular fibres, about 0·085 mm. in diameter, the meshes of which are subdivided by more slender fibres of the same character, and to some extent by single spicules. There is no recognisable spongin in any part of the skeleton.

Spicules:—Slightly curved oxea; sharply and fairly gradually pointed at each end; measuring about 0·26 by 0·012 mm.

The generic position of this species is somewhat doubtful. The skeleton arrangement is that of *Halichondria* (or *Petrosia*) rather than of *Reniera*, while the spicules are short for a *Halichondria* but long for a *Reniera*.

Register No., Locality, &c.—XLVIII. 2; Lat. 52° 23′ S., Long. 63° 50′ W., E. of the Straits of Magellan, April 13th, 1913.

Sub-family CHALININÆ.

35. *Chalina oculata*, Bowerbank [1866, 1874], var. *novæ-zealandiæ*, nov.

The single specimen in the collection consists of an elongated, subcylindrical stem, dividing dichotomously into four branches, three of which are very long and the fourth much shorter. The total length of the specimen is about 470 mm. and the diameter of the stem and branches about 8 mm. Numerous small vents, about 2 mm. in diameter, with prominent margins, are arranged, for the most part serially, along stem and branches. The colour in spirit (macerated) is light brown, the texture soft, compressible, resilient.

The main skeleton is a very wide-meshed network of stout horny fibre, rather sparingly cored with oxea, in single or multiple series. The network is very irregular and the fibres vary much in diameter, up to about 0·085 mm. The dermal skeleton is a much closer reticulation of fibres, each about 0·034 mm. in diameter, cored by a single series of oxea and echinated by oxea projecting at right angles to the surface.

Spicules:—Short, fairly stout oxea; straight or nearly so, subfusiform, gradually and sharply pointed at each end; measuring about 0·088 by 0·008 mm.

This variety differs from the common British form in its more sparingly branched character and the much greater length of the branches. In these respects it resembles more closely the common Australian species described by Carter [1885–6] under the name *Chalina polychotoma*, which, however, is a very variable form. It differs from both in the very coarse, open character of the skeletal network. The spicules are a good deal shorter than those of the British form and a good deal larger than those of the Australian specimens examined by me.

Lendenfeld [1887], in that hopeless work, "Die Chalineen des Australischen Gebietes," has identified with the British species—but under the name *Euchalinopsis oculata*!—a sponge from Port Chalmers, New Zealand, but as the spicules of this sponge are said to measure 0·26 by 0·004 mm. the identification must remain doubtful. (In the British form they measure about 0·12 by 0·008 mm.)

Gray's *Spongia ramosa*, re-described in my paper "On the Sponges described in Dieffenbach's 'New Zealand'" [1898], under the name *Chalina ramosa*, may be regarded as another variety of the same species.

Register No., Locality, &c.—XI; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

36. *Pachychalina aurantiaca* (Lendenfeld).

Cladochalina aurantiaca, Lendenfeld [1887]; *Pachychalina aurantiaca*, Dendy [1895].

There is a single dry specimen in the collection which I refer with some hesitation to this species. In external appearance it resembles the Victorian specimens described by me, but in skeletal features it seems to come nearer to the type.

The specimen consists of a single compressed lobe or lamella attached to a broken gastropod shell. The attachment is broad and the outline of the sponge obcordate, the margin showing a slight tendency to give off very short, digitiform processes. Numerous vents, 2–3 mm. in diameter, are scattered over both surfaces and along the margin. The height of the specimen is about 98 mm., the greatest breadth 78 mm., and the thickness in the middle about 20 mm. The texture is firm and rather hard, but compressible and fairly resilient, and the colour is light greyish brown.

The main skeleton is a rather coarse network of stout horny fibre, cored by numerous slender oxea, more abundant in the primary than in the secondary lines. The primary fibres curve outwards towards the surface and are about 0·12 mm. in diameter; the secondaries, about 0·05 mm. thick, meet them at right angles. The dermal skeleton is an irregular, more closely meshed network of slenderer but still multispicular fibres, not echinated by tufts of projecting spicules as described in my Victorian specimens (but not in the type).

Spicules:—Very slender, straight or slightly curved oxea, measuring about 0·08 by 0·002 mm.

Previously known Distribution.—South coast of Australia, Port Phillip and neighbourhood (Lendenfeld, Dendy).

Register No., Locality, &c.—XXXIII. 15; off Three Kings Islands, N. of New Zealand.

37. *Ceraochalina pergamentacea* (Ridley).

> *Cladochalina armigera*, Schmidt, var. *pergamentacea*, Ridley [1881]; *Cladochalina pergamentacea*, Ridley [1884]; *Chalina pergamentacea*, Ridley and Dendy [1887]; *Ceraochalina papillata*, Lendenfeld [1887]; *Chalina pergamentacea*, Dendy [1895].

There is a single specimen of this common Australian species in the collection. It takes the form of an unbranched, flattened, digitiform growth attached to a lamellibranch shell. The total height, excluding the part attached to the shell, is about 90 mm.; the maximum width, near the apex, about 20 mm. Both flat surfaces bear numerous small vents (about 1 mm. in diameter), each on a rather prominent papilla. The surface is smooth and subglabrous in spirit, but finely granulated; the colour dark brown, and the texture rather firm, but compressible and resilient.

The main skeleton is a rather wide- and rectangular-meshed reticulation of stout horny fibre, sparsely cored by slender vestigial oxea, arranged multiserially in the primary lines and uniserially in the secondaries. There is a well-developed dermal reticulation of more slender fibres, uniserially cored, and sparsely echinated by vestigial oxea projecting at right angles to the surface.

Spicules:—Slender oxea, straight or nearly so, sharply pointed at each end, measuring about 0·044 by 0·002 mm. (vestigial).

I see nothing by which this sponge can be distinguished from Australian specimens. Lendenfeld [1887] has described three varieties of his *Ceraochalina papillata* from New Zealand, which seem to differ from one another and from our specimen in no important respect.

Previously known Distribution.—East coast of Brazil (Ridley); Torres Straits (Ridley); Bass Straits (Ridley and Dendy, Dendy); New Zealand (Lendenfeld).

Register No., Locality, &c.—XXXVI; Station 134, Spirits Bay, near North Cape, New Zealand, 11–20 fathoms.

38. *Siphonochalina communis* (Carter).

Tubulodigitus communis, Carter [1881]; *Patuloscula procumbens*, Carter [1882]; *Patuloscula procumbens*, Carter [1885–6]; *Siphonochalina intermedia*, Ridley and Dendy [1887]; *Siphonochalina procumbens*, Dendy [1890]; *Siphonochalina procumbens*, Dendy [1895]. (For other possible synonyms *vide* Dendy [1916 A].)

There are in the collection three dry specimens of this common and widely distributed species, all different as regards the shape and arrangement of the tubes but agreeing closely in skeletal characters. In R. N. XXXIII. 5, which has a well-developed stalk, the tubes tend to fuse together in one plane, fan-wise, as in Carter's var. *flabelliformis*, and an interesting feature of this specimen is the presence of numerous small, circular oscula, more or less serially arranged, on the outer surface of the lower part of the sponge, as seen so frequently in non-tubular Chalininæ.

R. N. XXXIII. 2 closely resembles the Australian *Siphonochalina intermedia* as figured by Ridley and Dendy in the "Challenger" Report, while R. N. XXXIII. 10 has much smaller tubes, much more extensively fused together in a bushy fashion.

In all three the spongin is very strongly developed in proportion to the spicules, which are short, straight (or nearly straight), sharply pointed oxea, measuring about 0·04 to 0·06 by 0·004 to 0·006 mm.

Previously known Distribution.—West Indies, Indian Ocean, Australia.

Register Nos., Locality, &c.—XXXIII. 2, 5, 10; N. of New Zealand (? off Three Kings Islands).

39. *Siphonochalina minor*, Dendy [1916 A], var. *regalis*, nov.

There are several pieces of this sponge in the collection, all from the same locality, and possibly parts of the same colony. The piece which I regard as the type consists of a ramified stolon, about 8 mm. in diameter, probably procumbent in life, from which short tubular branches (about nine in number) of about the same diameter are given off serially on one side, the stolon itself not being tubular. Each tubular branch possesses a single terminal vent about 3 mm. in diameter and is itself about 10 mm. long. The maximum length of the specimen is about 115 mm. A slender connecting strand forms an anastomosis between two portions of the stolon, which was probably reticulate. The texture is very soft, compressible and resilient.

The colour is now black, but it has apparently been stained, like everything else in the jar, with osmic acid, and is in a very macerated condition.

The main skeleton is a subrectangularly, very wide-meshed network of spicular fibre about 0·05 mm. in diameter. The spicules are arranged multiserially in both primaries and secondaries, but there is a fairly thick coating of spongin. The dermal skeleton is a close-meshed reticulation of plurispicular fibre in which the sides of the meshes are often not more than one spicule in length. There is a fair amount of spongin in the fibre, but it does not form a complete investment. This dermal skeleton is abundantly echinated by oxea, projecting singly or in small groups.

Spicules:—Short, stout, slightly curved, fusiform oxea, gradually sharp-pointed at each end; measuring about 0·1 by 0·009 mm.

This variety differs from the type of the species in three chief features, none of which appears to me to deserve specific recognition. In the first place the dermal skeleton is somewhat differently arranged, being, in the type, an irregular, unispicular reticulation without obvious spongin, and without projecting oxea. In the second place the spicules are considerably stouter than in the type, though not quite so long; and, in the third place, there is more spongin throughout.

Previously known Distribution of Species.—Okhamandal, Indian Ocean (Dendy).

Register No., Locality, &c.—XIX. 1; Station 90, off Three Kings Islands, New Zealand, 100 fathoms.

40. *Siphonochalina latituba*, n. sp. (Pl. X, figs. 7 and 8.)

There are five specimens of this sponge in the collection, all from the same locality; of which the largest (R. N. III, Pl. 10, fig. 8) may be regarded as the type. This consists of a single, straight, unbranched, greatly elongated, thin-walled, trumpet-shaped tube, gradually increasing in diameter from the narrow base of attachment, which forms a solid stalk, to the wide opening at the summit. The outer surface is smooth but finely granular; the inner surface is perforated by very numerous minute apertures. The total height is 380 mm., the diameter at the base 10 mm., and at the apex (terminal opening) about 33 mm. The thickness of the wall is only about 2·5 mm., diminishing to a sharp edge at the margin of the terminal opening. The texture is soft and very compressible, so that the thin wall collapses more or less in spirit. The colour in spirit (of all the specimens) is pale brown, but all seem to be completely macerated, and the colour is that of the skeleton.

The remaining specimens, though smaller, closely resemble that described above. Only in one case (R. N. LVII. *b*) does any branching take place. In this specimen (fig. 7) a single, much more slender, secondary tube is given off from about half-way up the main tube, of which it repeats the structure on a smaller scale. Coming off at first nearly at right angles, it soon bends sharply upwards and runs parallel to the parent tube, without, however, reaching the same height.

The skeleton consists of a coarse-meshed network of horny fibre, of a rather

dark, yellowish-brown colour, cored throughout by small oxea. When viewed in transverse section of the wall the meshes appear rectangular or subrectangular; in paratangential section, polygonal. The meshes are widest, up to about 0·5 mm., in the inner portion of the wall, and become much smaller towards the surface. There appear to be no main longitudinal fibres running from the stem upwards, but the primary fibres run at right angles from surface to surface and are joined by secondaries of about the same diameter (say about 0·05 mm.). Both primary and secondary fibres are usually plurispicular and there is not much difference between them in this respect. In the inner portion of the wall the amount of spongin in proportion to the spicules is very great. Towards the outer surface, where the meshes become smaller and the fibres more slender, the proportion of spongin diminishes, and the outermost part of the network is echinated by little tufts or brushes of almost free spicules projecting at right angles to the surface.

Spicules:—Short, straight or very slightly curved oxea; fairly stout, subfusiform, gradually and sharply pointed at each end; measuring about 0·12 by 0·008 mm.

This very interesting species appears to be nearly related to Lendenfeld's *Chalinopsilla tuba*, from Torres Straits [1889, p. 133], which it resembles closely in external form, and which has very likely been derived from our species by loss of spicules.

Register Nos., Locality, &c.—III, LVII. *a–d*; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

41. *Siphonochalina stellidermata* (Carter).

Spongelia stellidermata, Carter [1885–6]; *Spongelia elastica* var. *stellidermata*, Lendenfeld [1889].

There is a single specimen in the collection which I refer with some hesitation to Carter's species. It is flabellate, and may be regarded as composed of a number of rather thick-walled cylindrical tubes, fused together laterally and radiating, fan-like, from below upwards. The specimen may have been stipitate, like the type, but the lower part has been torn off. The remaining portion is 68 mm. high by 86 mm. in breadth and 14 mm. in thickness. The surface shows radiating furrows between the component tubes, each of which latter has a wide, circular vent on the slightly uneven, curved margin. The vents vary up to about 7 mm. in diameter, and there are seven of them. The raised, stellate marking of the surface from which the specific name is derived is very strongly developed, but it sometimes passes into transverse ridges in the grooves between the tubes. The texture in spirit is very compressible and elastic, the colour greyish brown.

The main skeleton consists of stout primary fibres, running across the wall of the tube, approximately at right angles to the surface and at intervals of about 1·5 mm., connected by secondary fibres which run parallel with the surface and are

sparingly interconnected amongst themselves. The primary fibres are about 0·1 mm. in diameter and abundantly cored with sand. The secondaries are about 0·05 mm. in diameter and free from foreign matter. All the fibres are very distinctly laminated, and in balsam preparations many show numerous elongated black markings, due, apparently, to intrusion of air between the laminæ. These markings disappear in stained paraffin sections. The characteristic dermal reticulation is formed by the younger of the secondary fibres, radiating from near the apices of the primaries. These appear to be softer than the older fibres, and have a curious shrivelled appearance, with very uneven surface. The youngest and most superficial of all are comparatively few in number, and very slender, only about 0·025 mm. in diameter. These have smooth outlines and are very densely charged with intrusive air. There is a good deal of coarse foreign matter, large foreign spicules, &c., between the skeleton fibres.

The poor state of preservation makes it impossible to give a satisfactory account of the canal-system. The flagellate chambers appear to be subspherical, about 0·04 mm. in diameter, eurypylous, and suspended in a lacunar, collenchymatous, but more or less granular mesogloea. The thin, transparent dermal membrane no doubt contained numerous inhalant pores, though these are no longer recognisable. The smaller exhalant canals open by numerous apertures into the wide oscular tubes.

I have very little doubt that this sponge is a pseudoceratose *Siphonochalina*, a conclusion which is supported alike by the characteristic external form, the skeleton arrangement, and the canal-system.

Previously known Distribution.—Port Phillip Heads, Victoria (Carter).

Register No., Locality, &c.—VI; off North Cape, Auckland, New Zealand, sandy bottom, 30–14 fathoms, August 2nd, 1911.

42. *Chalinopsilla palmata* (Carter).

Dactylia palmata, Carter [1885–6]; *Chalinopsilla arborea*, var. *macropora*, Lendenfeld [1889].

There is a single dry specimen of this species in the collection, agreeing very well with Carter's brief description and fairly well with Lendenfeld's fig. 10 (Pl. I, *op. cit.*). It consists of a bunch of much elongated, usually more or less flattened and sometimes expanded, dichotomously dividing branches, with numerous conspicuous vents, about 2–3 mm. in diameter, scattered over the surfaces, and to a slight extent only along the margins. The total height is 270 mm., the maximum width of any branch 35 mm. The texture is coarse, compressible, and resilient, the colour light brownish grey. The surface is still slightly sandy in places, but most of the dermal layer appears to have been removed, the specimen being completely macerated.

The main skeleton consists of stout primary fibres of spongin curving upwards and outwards to the surface at distances of about 0·8 mm., connected at right angles by more slender secondaries, which become more numerous towards the surface.

The primary fibres are about 0·085 mm. in diameter and are abundantly cored by sand grains. The secondaries are free from sand and about 0·05 mm. thick. There are mere traces of a sandy dermal reticulation.

I have no hesitation in regarding this sponge as a Chalinine which has completely lost its spicules, and therefore as being pseudoceratose.

It is very doubtful whether the species is distinct from Carter's *Dactylia chaliniformis*, described in the same place. Were it not that the name had been previously used under the forms *Dactylium* and *Dactylius* I should not hesitate to give Carter's genus priority over Lendenfeld's.

Previously known Distribution.—Australian Seas, Port Phillip Heads (Carter), Port Jackson (Lendenfeld); New Zealand, Port Chalmers (Lendenfeld).

Register No., Locality, &c.—XXXIII. 9; off Three Kings Islands, N. of New Zealand.

Sub-family PHLŒODICTYINÆ.

43. *Oceanapia* (?) *arcifera*, n. sp. (Pl. XIII, figs. 4 and 5.)

This species is represented in the collection by a somewhat frayed fragment of a rather thin-walled fistula, with a small portion of the wall of possibly another fistula adhering to it. The larger fragment measures about 33 by 6 mm. and is now of a dark blackish-grey colour, apparently due to staining by osmic acid.

The skeleton consists of a dense dermal felt-work of tangentially disposed oxea, backed up by stout longitudinal bundles of similar oxea anastomosing with one another here and there to form a loose, coarse network. Although the longitudinal bundles form well-defined spicular fibres there appears to be little if any spongin cement.

Spicules:—(1) Oxea (Pl. XIII, fig. 4); rather slender, slightly curved or angulated in the middle, gradually and very sharply pointed at each end; measuring about 0·24 by 0·008 mm.

(2) Toxa (fig. 5); rather strongly and usually sharply angulated in the middle, with short, fine, recurved apices; rather stout, but varying very greatly in size, up to about 0·08 by 0·003 mm. Very abundant. Numerous short, slender forms met with are probably young.

Although so inadequately represented, this species seems worth describing, as it seems likely to be readily recognisable when again met with. It may be nearly related to *Oceanapia toxophila*, Dendy [1921], from the Indian Ocean, but is sharply distinguished by the absence of sigmata and the character of the oxea.

Register No., Locality, &c.—LV. 3; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

44. *Phlœodictyon fistulosum* (Bowerbank)?

(For references and synonyms *vide* Dendy [1905].)

There are in the collection two much elongated and irregularly curved, thin-

walled, cylindrical fistulæ, open at both ends, which may be regarded as certainly belonging to the genus *Phlæodictyon*, and probably to the species named. The longer of the two is about 70 mm. in length and 4 mm. in diameter. The colour (in spirit) is now almost black, but the specimens have evidently been treated with osmic acid, like others in the same jar.

The skeleton consists of an internal bast-like layer of stout longitudinal bundles of oxea, sometimes branching and anastomosing, and an external layer consisting of an irregular reticulation of single oxea, placed tangentially and overlapping one another freely in all directions. The oxea are slightly curved, sharply and fairly gradually pointed at each end, and measure about 0·3 by 0·017 mm.

The spicules seem to be rather more robust than is usual in the species, but not sufficiently so to require specific distinction.

Previously known Distribution.—Almost cosmopolitan [see Dendy, 1921].

Register Nos., Locality, &c.—LV. 8, 12; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

45. *Phlæodictyon aberrans*, n. sp.

The more perfect of the two specimens (R. N. XIX. 9) consists of a short, subcylindrical body, broken off below and tapering above into a group of long and rather slender, thin-walled fistulæ. There appear to have been five of these fistulæ, all erect and some of them more or less fused together. Except when broken off they terminate in narrow, tapering, blind extremities. There are no recognisable vents. The transverse diameter of the body is about 20 mm., the total height of the specimen 71 mm., the length of the longest fistula about 45 mm. Both specimens have evidently been treated with osmic acid, and are nearly black externally; yellowish grey internally. The surface, of both body and fistulæ, is characteristically granular, or minutely sub-hispid. The body is fairly firm and compact, but compressible; crumb-of-bread-like internally. The fistulæ are rather soft and flabby, with the cavity traversed by an open reticulation of gelatinous-looking tissue. The second specimen has all the fistulæ broken off quite short, but otherwise closely resembles that described above.

The main skeleton of the body is an irregular reticulation of short oxea, chiefly in stout, loose fibres or tracts, apparently without spongin; interrupted by extensive masses of lacunar collenchyma without skeleton. There is no distinct, bast-like, subdermal layer of spicular fibre, as in typical specimens of *Phlæodictyon*, and the dermal skeleton is represented only by close-set brushes of short oxea, whose projecting ends give the characteristic sub-hispid appearance to the surface. In the fistulæ the skeleton is more typical, with a distinct, subdermal, bast-like reticulation of spicular fibre, in which the deeper and stouter fibres run more or less longitudinally. The surface brushes are perhaps less well-developed than on the body.

Spicules:—Of one kind only, viz. rather short, slightly curved or angulate, fairly

stout, subfusiform oxea, gradually and sharply pointed at each end; measuring about 0·25 by 0·013 mm.

The sponge contains, especially in its outer portion, an immense number of "cellules sphéruleuses"—which appear as dense clusters of spherical granules staining deeply with osmic acid. In paraffin sections, from which their contents have apparently been dissolved out, they look like groups of minute spherical vesicles, the entire group about 0·024 mm., and the individual vesicles about 0·004 mm. in diameter. They are probably stores of reserve material (thesocytes), but it is noteworthy that they seem usually to be attached rather to the inner surfaces of the subdermal cavities than actually embedded in the tissues. More or less similar structures have frequently been described in the genus *Phlœodictyon*.

Register Nos., Locality, &c.—XIX. 8, 9; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

Family DESMACIDONIDÆ.

Sub-family ESPERELLINÆ.

Section *Isodictyeæ*.

Genus Isodictya, Bowerbank [1864].

Esperellinæ with oxeote megascleres and palmate isochelæ.

In establishing his genus *Isodictya*, Bowerbank named two type-species, *Isodictya palmata* and *I. Normani*. These are very different sponges, the latter is evidently an *Esperiopsis* and the former, being mentioned first, must clearly be regarded as the real type-species of the genus *Isodictya*. Gray [1867] only made matters worse by employing the generic name *Isodictya* twice over in different senses. Ehlers [1870], also recognising that Bowerbank's genus was too comprehensive, proposed the name *Homœodictya* for a section thereof, but unfortunately he actually applied the new name to Bowerbank's type-species, viz. *I. palmata* (= the *Spongia digitata* of Esper according to Ehlers).

In this respect Ehlers' unfortunate example was followed by Ridley and Dendy [1887], who proposed to restrict *Homœodictya* to species with the peculiarly shaped palmate isochelæ characteristic of *H. palmata*, and to regard it as a subgenus of *Desmacidon*. Lundbeck [1905] also accepted the genus *Homœodictya*, while somewhat extending its scope and separating it from *Desmacidon*. It is quite clear, however, that the name *Homœodictya* should never have been allowed to replace *Isodictya* if we are going to pay due attention to the laws of priority. I therefore revert to Bowerbank's name, although most of the species referred by him to *Isodictya* have had to find refuge elsewhere (e. g. in *Reniera*); and I agree with Lundbeck in associating with *Isodictya palmata* a number of species in which the palmate isochela is of a more ordinary type.

The genus *Desmacidon* may be distinguished from *Isodictya* on the ground that the isochelæ are tridentate and not palmate. I have hitherto used *Desmacidon* to include species with isochelæ of either type, but I now think that this is a mistake, and in any case, if the two genera are to be merged, *Isodictya* would seem to have priority over *Desmacidon*.

46. *Isodictya cavicornuta*, n. sp. (Pl. X, figs. 2 and 3.)

This species is represented by a large number of dry pieces, more or less broken up, all from the same locality. It is quite impossible to say how many originally separate specimens they represent. They are comprised under two numbers, XXXIII. 12 and XXXIII. 13. From amongst these I have picked out a series of the least damaged to represent the range of external form, and labelled them XXXIII. 12. *a-g* and XXXIII. 13. *a* ; these may be regarded as co-types.

The form ranges from more or less deeply funnel-shaped, or horn-like (Pl. X, fig. 2), to tubular-cylindrical, slightly curved (fig. 3). Some specimens show clear indications of branching, and it is probable that in the living condition the sponge forms loose colonies of funnel-shaped or cylindrical "individuals" united together basally.

The most perfect funnel-shaped piece (R. N. XXXIII. 12. *b*, fig. 2) is about 120 mm. in height, with a diameter at the base of about 22 mm., and at the mouth, which is very slightly constricted, of about 40 mm. A projection at one side may indicate the attachment of a branch, now broken off. (Unmistakable evidence of branching occurs in R. N. XXXIII. 12. *d*.) The lower, stalk-like portion is almost solid, but it expands quite gradually upwards, and as it does so the central cavity gradually widens out to form a deep funnel, with the wall some 8 or 10 mm. thick in the middle and thinning gradually to the margin. The inner surface is perforated by numerous circular apertures, ranging in diameter up to about 3 mm. The outer surface is also abundantly perforated, but the apertures do not reach so large a size. Another funnel-shaped specimen (R. N. XXXIII. 12. *c*) has a mouth about 60 mm. in diameter.

As an example of a tubular specimen we may take R. N. XXXIII. 12. *g* (fig. 3), which is slightly curved, about 135 mm. in length, with a very uniform diameter of about 25 mm. and a slightly constricted terminal aperture about 12 mm. in diameter, this being also the internal diameter of the tube, the wall being some 6 or 7 mm. thick.

These two extremes are connected by intermediate forms.

The texture of the sponge is coarsely fibro-reticulate, and very friable. There is no dermal membrane remaining on either surface, inside or out. The colour is pale brownish grey.

The skeleton is a close, irregular reticulation of coarse spicular fibre, loose spicule bundles, and isolated spicules, with little or no spongin.

Spicules:—(1) Stout oxea, slightly curved or even angulate, sharply and fairly gradually pointed at each end; very rarely stylote; measuring about 0·65 by 0·032 mm. A number of shorter and much more slender oxea, sometimes toxiform, may also occur; but they appear to be merely young forms of the larger ones, with which they are connected by intermediates.

(2) Palmate isochelæ, about 0·064 mm. in length; of ordinary form, without the inward projection on the inner surface of the palm which characterises such species as *I. palmata*; the palm widening to the free end, which is broadly rounded; the alæ of each side completely separated from one another, about three-sixteenths of the shaft, in the middle, being entirely free from fimbria.

This interesting species is distinguished chiefly by its remarkable external appearance; but the large size of the palmate isochelæ is also noteworthy, while the more ordinary form of this spicule serves to distinguish the species from those which were included by Ridley and Dendy in the genus *Homœodictya*.

Register Nos., Locality, &c.—XXXIII. 12 and 12. *a–g*, 13 and 13. *a*; off Three Kings Islands (or off North Cape ?), New Zealand.

Section *Guitarreæ*.

47. *Guitarra antarctica*, Hentschel [1914], var. *novæ-zealandiæ*, nov.

This variety is represented by some small fragments removed by Mr. Row from the surface of a specimen of *Jaspis novæ-zealandiæ* (R. N. XXX. 1), and mounted in Canada balsam. It differs from the type chiefly in the absence of the larger placochelæ and the smaller size of the sigmata.

The megascleres are somewhat unequal-ended oxea, measuring about 0·3 by 0·006 mm., densely and irregularly scattered, and in loose fibres and wisps. These spicules are straight or slightly crooked. Both ends are more or less sharply and gradually pointed, but one is usually rather more slender and more gradually pointed than the other.

The placochelæ are of quite ordinary form, but only 0·04 mm. long and rather scarce.

The sigmata are very small and inconspicuous, though numerous. They are very slender, C-shaped, and about 0·01 mm. long.

The type of the species was obtained from deep water in the Antarctic.

Register Nos., Locality, &c.—XXX. 1. *h*, *i*; Station 144, near Cape Maria van Diemen, New Zealand, 35–40 fathoms.

Section *Mycaleæ*.

48. *Mycale magellanica* (Ridley).

Esperia magellanica, Ridley [1881]; *Esperia cunninghami*, Carter [1882]; *Esperella magellanica*, Ridley and Dendy [1887]; *Mycale magellanica*, Thiele [1905].

There is a very fine, large specimen (R.N. XXII) of this species in the collection. The external appearance, though more irregular, is essentially similar to that figured

by Ridley. There are, as pointed out by Thiele, three chief sizes of palmate anisochelæ. Ridley probably took the smaller ones for young forms of the larger, a mistake very common at the time when he wrote. I have seen only very poor rosettes, but Thiele mentions them. The unusually stout, fusiform rhaphides, occurring usually in bundles, form a very characteristic feature of the species. Each individual rhaphis measures about 0·06 by 0·002 mm., and tapers to a fine point at each end. There are no sigmata.* Masses of light brown, coarsely granular cells, in and beneath the dermal membrane, are very conspicuous.

A second specimen (R. N. XLVIII. 1), also of columnar form, and from the same locality, agrees very closely with the above. It also contains no sigmata.

Register Nos., Locality, &c.—XXII; XLVIII. 1; N. of Cape Horn, April 13th, 1913, Lat. 52° 23′ S., Long. 63° 50′ W., 125 fathoms.

49. *Mycale lilliei*, n. sp.

Sponge somewhat flattened, tongue-shaped or lobate, apparently attached by one end in life, as indicated by the inclusion of coarse sand in the base. The interior is cavernous, with a number of openings to the exterior, of which some are undoubtedly vents, but these vents are not easy to distinguish owing to the damaged condition of the surface. There seem to be typically a few large vents situated on the edges or summits of the more or less flattened lobes and leading out of large oscular canals. The surface is rather uneven, often mammillated, and normally covered with a thick, easily separable, dermal membrane that frequently has a blistered appearance. There are no pore cracks. The texture is very soft and spongy; compressible, resilient, internally coarsely fibrous. The largest specimen measures about 123 mm. in height by 89 mm. in greatest breadth and 58 mm. in greatest thickness. Several others are of nearly the same size, sometimes more compressed; other much smaller ones are perhaps fragmentary. The colour in spirit is pale yellowish grey.

The main skeleton is very coarsely fibro-reticulate; the main fibres spreading out into brushes of megascleres beneath the surface to support the dermal membrane. The principal fibres, in the interior of the sponge, are compact and very stout. Numerous separate megascleres are scattered in the meshes of the reticulation. The dermal skeleton is an irregular reticulation of loose bundles of megascleres lying tangentially. There is no recognisable spongin in any part of the skeleton.

The following account of the spiculation is taken from R. N. XX. 3, which may be regarded as the type of the species. It is a typical, tongue-shaped, compressed specimen, 130 mm. in height by 65 mm. in breadth and 33 mm. in thickness, with surface projections ranging from low and blister-like to acutely conulose.

Spicules:—(1) Subtylostyli, of one size only; straight or nearly so; with very

* I have actually seen one, but it may be foreign.

feebly developed, oval heads, and rather abruptly sharp-pointed apices; size about 0·5 by 0·014 mm. Occasionally polytylote (abnormal?).

(2) Palmate anisochelæ of the first size; about 0·065 mm. in length. Perfectly typical, with only slightly curved shaft and broad palms; the large and small palms both ending very broadly and almost squarely. Frequently in very beautiful rosettes beneath the dermal membrane.

(3) Palmate anisochelæ of the second size; about 0·04 mm. long. Very similar to (2), but perhaps differing in the presence of a slight projection in the middle of the free edge of the small palm, though I think this sometimes occurs in (2) also.

(4) Palmate anisochelæ of the third size; about 0·024 mm. long. Closely resembling (2) and (3).

None of the chelæ have terminally projecting spurs at the small end.

(5) Large and fairly stout sigmata, more or less contort, of quite ordinary form. Size about 0·16 mm. from bend to bend, by 0·005 mm. in diameter in middle of shaft. The two ends rather sharply incurved and finely pointed, but not drawn out. Very abundant.

(6) Small sigmata, very similar to (5) but only about 0·048 mm. from bend to bend. Much less numerous.

(7) Short, fusiform rhaphides, or perhaps better, microxea; about 0·04 mm. long by 0·002 mm. thick in the middle; gradually and sharply pointed at each end; occurring singly or in small bundles (trichodragmata). Extremely rare in this specimen.

There can be no doubt that this species is closely related to *Mycale magellanica*, from which it differs chiefly in the presence of sigmata. The rhaphides (microxea) are unusually stout and in this respect agree with those of *Mycale magellanica*, and I know of no points of distinction as regards the remainder of the spiculation. Moreover, the number of sigmata present in *M. lilliei* varies enormously in different specimens, and apparently in inverse ratio to the number of rhaphides. Thus, while R. N. XX. 3 has a great many sigmata and hardly any rhaphides, R. N. XX. 1 has very few large sigmata, abundant but very slender small sigmata, and very abundant trichodragmata (composed of the unusually stout microxea); R. N. XX. 8, again, has very few large sigmata, a few very slender small sigmata, and abundant trichodragmata.

I am not aware that sigmata have ever been recorded for *M. magellanica*, but I have found one, which may of course be foreign, in my preparations of the "Terra Nova" specimen.

So far as regards the spiculation, then, there seems to be no really sharp distinction between the two species in question; but the uncompressed, massive, or columnar form of *M. magellanica* appears to be characteristic and it is perhaps

as well to keep the two distinct for the present. Probably *M. magellanica* has been derived from *M. lilliei* by loss of sigmata and a slight change of habit.

Register Nos., Locality, &c.—XX. 1–8; N. of Cape Horn, 125 fathoms. April 13th, 1913.

50. *Mycale novæ-zealandiæ*, n. sp. (Pl. V, fig. 3; Pl. 13, figs. 6–13.)

The single specimen in the collection (Pl. V, fig. 3) is pear-shaped, and has evidently been attached by the narrow end. The height is 84 mm. and the maximum breadth 44 mm. The surface is greatly corrugated, apparently as the result of contraction, and very minutely hispid. The vents are small, about 1 mm. in diameter, with very slightly prominent margins; fairly numerous on the broadly rounded upper part of the sponge. The inhalant pores are presumably in the floors of ramifying pore cracks. The cracks themselves are easily recognisable here and there, with prominent margins, but the marginal brushes of styli are not nearly so well defined as in *M. murrayi* [Ridley and Dendy, 1887], and the actual pores are not recognisable. The texture is rather spongy and compressible; internally coarsely fibrous, owing to the strongly developed spicular fibre of the main skeleton, which has been exposed by stripping of the superficial tissues in the lower part of the sponge (fig. 3). The colour (in spirit) is blackish grey, as though stained with osmic acid.

The main skeleton is composed of stout but rather ill-defined bundles of styli, radiating from the interior of the sponge, where they form an irregular reticulation, to the surface, where they end in well-developed dermal brushes projecting through the dermal membrane. There is a strongly developed subdermal reticulation of very loose, coarse, spicular fibre, lying a very short way beneath the dermal membrane, but separated from it by a distinct interval. There is no recognisable spongin.

Spicules:—(1) Long styli (Pl. XIII, fig. 13); straight, subfusiform; evenly rounded off at the narrow base or with very feebly developed, oval heads; gradually and finely pointed at the apex, measuring up to about 1·12 by 0·024 mm. Characteristic of the main skeleton.

(2) Short styli (fig. 12); straight or slightly curved; similar to (1), but much shorter; say about 0·5 by 0·016 mm. Characteristic of the dermal brushes. Of course intermediates between (1) and (2) occur abundantly.

(3) Large palmate anisochelæ (figs. 11 *a* and 11 *b*); very similar to those of *Mycale placoides* as figured by Lundbeck, but differing in that the fluke or palm at the large end projects from the shaft at a much wider angle, giving a characteristically short and wide-spreading appearance to the large end. These spicules measure about 0·088 mm. in length; they are very abundant, forming magnificent rosettes scattered beneath the surface and in the deeper parts of the interior.

(4) Intermediate palmate anisochelæ (figs. 10 *a* and 10 *b*); of more ordinary form; not forming rosettes; few in number; about 0·036 mm. long.

(5) Small palmate anisochelæ (figs. 9 *a* and 9 *b*); of ordinary form; not forming rosettes; very abundant throughout the sponge, but especially in the dermal membrane, where they occur in myriads; about 0·024 mm. long.

These three categories of anisochelæ appear to be sharply marked off from one another, there being but little variation of size or form within each.

(6) Large, stout sigmata (fig. 7); more or less contort; usually about 0·06 mm. from bend to bend, occasionally up to 0·08 mm. Very abundant throughout the interior.

(7) Small, slender sigmata (fig. 6); more or less contort; usually about 0·016 mm. from bend to bend; very abundant.

These two categories of sigmata are also pretty sharply marked off from one another, though intermediates are not wanting.

(8) Trichodragmata (fig. 8); perfectly typical, oblong bundles, measuring about 0·08 by 0·016 mm., separating into very slender, hair-like rhaphides in boiled out preparations; abundant in the more superficial parts of the interior.

This species evidently comes very near to *Mycale* (*Esperia*) *placoides*, Carter [1876], as re-described by Lundbeck [1905]. This is a characteristic North Atlantic species, as also is the closely related *Mycale lingua* (Bk.). They appear to be represented in Australian seas by *Mycale* (*Esperella*) *murrayi*, Ridley and Dendy [1887], and it is very interesting to find another closely related form in New Zealand waters. The New Zealand species, perhaps, comes nearer to *M. placoides* than to either of the others, but is distinguished by the shape of the large isochelæ and the presence of the larger sigmata.

The presence of the pore cracks is a characteristic feature of all these species and may possibly be found to serve as a means of generic distinction.

Register No., Locality, &c., XXIV; Station 90, near Three Kings Islands, 100 fathoms.

51. *Esperiopsis edwardii* (Bowerbank).

Isodictya Edwardii, Bowerbank [1866]; *? Isodictya paupera*, Bowerbank [1866]; *? Isodictya gracilis*, Bowerbank [1866]; *Amphilectus gracilis*, Vosmaer [1880]; *Amphilectus Edwardi*, Ridley [1883]; *Esperiopsis Edwardii*, var. *americana*, Ridley and Dendy [1887]; *Esperiopsis Edwardii*, Thiele [1905]; *Esperiopsis Edwardii*, Hentschel [1914].

There are a number of fragments of this species in the collection, all from the same locality; varying from small, flat pieces to elongated, flattened, or slender, cylindrical branches, with marginal rows of vents. One piece, at least, encrusts the stem of a hydroid colony, and it is not impossible that several of the fragments have been torn off from the same. The colour in spirit is light or dark grey, but two of the pieces have evidently been stained with osmic acid. The texture is very soft and fragile, without any axial condensation of the reticulate spicular skeleton.

The spiculation is perfectly typical, consisting of slightly curved styli, measuring

about 0·3 by 0·012 mm., and palmate isochelæ about 0·028 mm. long. Numerous foreign microscleres are present, including a very few toxa, but I do not think any of these can be regarded as belonging to the sponge. Very little spongin is present.

Previously known Distribution.—British Seas (Bowerbank, Ridley); Patagonia (Ridley and Dendy, Thiele); Kerguelen (Hentschel).

Register Nos., Locality, &c.—XIX. 4, 6, 12, 13, 14; XLVII. 1; LV. 10; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

52. *Esperiopsis macrosigma*, Stephens [1916, 1921], var. *novæ-zealandiæ*, nov. (Pl. XIII, figs. 14–20).

The specimen forms a thin brown crust on a block of black basalt, in company with many other organisms.

Spicules:—(1) Rather slender subtylostyli (Pl. XIII, fig. 14); approximately straight; gradually and sharply pointed; measuring about 0·425 by 0·0065 mm.

(2) Palmate isochelæ of the first category (figs. 15 *a* and 15 *b*); up to about 0·08 mm. long; closely resembling those of the type, but with a much shorter interval between the alæ of the two opposite ends, which tend to become confluent. Shaft nearly straight.

(3) Palmate isochelæ of the second category (figs. 16 *a* and 16 *b*); about 0·044 mm. long; with strongly curved shaft which sometimes seems to be connected by a thin membrane with each of the palms (in side view), an appearance which is almost certainly deceptive and due to inward curvature of the alæ.

(4) Palmate isochelæ of the third category (figs. 17 *a* and 17 *b*); about 0·016 mm. long; with rather strongly curved shaft.

(5) Giant sigmata (fig. 18); about 0·34 mm. from bend to bend; C-shaped, not contort.

(6) Small, slender sigmata (fig. 19); about 0·048 mm. long; more or less contort.

Intermediates occur, as might be expected, both amongst the chelæ and the sigmata.

The type of this species was obtained in deep water off the coast of Ireland, and it is extremely interesting to find a variety of it in deep water off the coast of New Zealand.

Register No., Locality, &c.—XXXV. *j*; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

53. *Esperiopsis megachela*, n. sp. (Pl. XIII, figs. 21–25).

This species is represented by a fairly thick but very friable crust (dry) of a pale brown colour, attached to the same block of basalt as the specimen of *Esperiopsis macrosigma*, var. *novæ-zealandiæ*. There is a distinct dermal membrane, with a dermal skeleton composed of a reticulation of more or less separate styli, supported on loose bundles of styli coming up from the deeper parts of the sponge. The

isochelæ are enormously abundant, both in the dermal membrane and in the deeper parts.

Spicules:—(1) Styli (Pl. XIII, fig. 21); straight or nearly so; evenly rounded off at the base, bluntly pointed at the apex; measuring about 0·76 by 0·016 mm. A few much more slender forms may occur mingled in the same skeletal bundles with the above.

(2) Palmate isochelæ of the first category (figs. 25 *a* and 25 *b*); up to 0·14 mm. in length and varying but little in size; the palm varying a good deal in width, but widest at the free end, where it is almost squarely truncated; alæ broad and slightly turned out at the free angles, leaving nearly one-third of the straight shaft quite free in the middle.

(3) Palmate isochelæ of the second category (figs. 23 *a* and 23 *b*); these spicules are quite different in form from the above; the shaft is more or less curved; the palm is much narrowed towards its free end, which is incurved; the alæ are also incurved, especially at the free angles, and the free, median portion of the shaft is a good deal shorter. They vary much in size, from about 0·04 to 0·1 mm. I at first thought that they could be separated into two categories, but this is not so.

(4) Palmate isochelæ of the third category (figs. 24 *a* and 24 *b*); only about 0·02 mm. in length; with rather strongly curved shaft and triangular palms broadest at the free ends.

This is an extremely interesting case, in which the three categories of isochelæ are quite sharply differentiated from one another by peculiarities of form. All are very numerous.

(5) Fairly stout, C- and S-shaped sigmata of ordinary form, with short, incurved ends (fig. 22); measuring about 0·064 mm. from bend to bend, very uniform in size; abundant.

(6) Smaller, flagelliform sigmata; curled almost into a circle and measuring about 0·024 mm. in maximum diameter from bend to bend. One or both ends are usually sharply recurved to form a short, sharp hook. These spicules are scarce and may perhaps be foreign, derived from a specimen of *Gellius flagellifer* growing on the same stone.

This very beautiful species appears to be sharply distinguished by the peculiar form of the isochelæ of the second category. Two other species, *E. decora*, Topsent [1904] and *E. flagellum* Lundbeck [1905], have been described as possessing flagelliform sigmata, but they are quite distinct from ours.

Register No., Locality, &c.—XXXV. *b*; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

Genus Artemisina, Vosmaer [1885].

Esperellinæ of various habit, with a reticulate skeleton of spicular fibre, or spicule bundles, composed of styli and more or less spongin-cement, and often with

dermal or subdermal brushes of more slender styli. Microscleres small, palmate isochelæ and toxa, to which sigmata may be added.

It seems doubtful whether this genus is sufficiently distinct from *Esperiopsis* to deserve recognition, but as it has been accepted by Lundbeck, Topsent and Hentschel, and as a fair number of species have been described which conform to the above diagnosis, I propose to retain it as a matter of convenience.

54. *Artemisina jovis*, n. sp. (Pl. XII, fig. 6.)

This fine species is represented in the collection by a single specimen (Pl. XII, fig. 6). It is stipitate, much compressed, flabellate, with a slight tendency to divide into flattened digitations at the margin. The stalk is about 60 mm. long and 13 mm. in diameter; subcylindrical. The lamina is about 235 mm. in length (height) by about 110 mm. in greatest breadth and 6 or 8 mm. in thickness.

The two surfaces are sharply differentiated as inhalant and exhalant respectively. The former is quite smooth, though slightly undulating, and covered with a thin, subglabrous (in spirit) dermal membrane, minutely reticulate under a pocket-lens, and no doubt perforated in life by the inhalant pores. The latter is similar in appearance, except for the presence of numerous conspicuous compound vents scattered over it, each consisting of a small group of apertures in the floor of a shallow depression, about 4 mm. in diameter, which sometimes (perhaps always in life) has a thin, prominent margin. The exhalant surface is somewhat convex and a good deal abraded; the inhalant surface is correspondingly concave and much less damaged. The texture of the lamina is firm but compressible, and rather friable. The colour in spirit is greenish grey, the green tint being due to staining by the copper tank in which the specimen was preserved.

The main skeleton is an irregular, sub-isodictyal reticulation of stout styli, in which the spicules are mostly arranged in loose bundles and fibres of varying thickness, held together by a moderate amount of spongin. There is a special dermal or subdermal skeleton consisting of radiate brushes of much more slender styli supporting the dermal membrane, with a few similar styli scattered tangentially in the dermal membrane itself.

Spicules:—(1) Stout styli of the main skeleton; usually rather strongly curved; broadly rounded off at the base, sharply and fairly gradually pointed at the apex; measuring about 0·39 by 0·024 mm.

(2) Styli or subtylostyli of the subdermal brushes; straighter and more slender; with smoothly rounded base and fairly gradually sharp-pointed apex; measuring about 0·3 by 0·012 mm.

(3) Small palmate isochelæ; about 0·012 mm. long; enormously abundant, but very inconspicuous on account of their slenderness.

(4) Toxa; resembling hair-pins with reflexed ends and with the central angle

opened out to varying extents; moderately stout, and with markedly roughened ends; each limb measures about 0·1 mm. in length by 0·002 mm. in thickness.

This species is characterised especially by its very distinctive external form and large size as compared with other species of the genus. There is nothing peculiar about the spiculation.

Register No., Locality, &c.—XXXII. 7; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

55. *Artemisina elegantula*, n. sp.

This remarkable species is represented by a single small specimen, which, fortunately, was well preserved. The sponge consists of a short stalk, gradually expanding upwards into a turbinate body, obliquely truncated above to form a slightly convex upper surface with an approximately circular margin, below which a shallow groove runs round the sponge. Nearly in the middle of the upper surface is the single, rather small vent, surrounded by a thin, membranous collar (containing megascleres). The sides and top of the sponge-body are alike covered by a thin, transparent, probably pore-bearing, dermal membrane, through which can be seen with a lens the underlying reticulation of tissue. The interior of the sponge is somewhat cavernous; the texture is soft and resilient; the colour in spirit is pale yellowish grey. The total height of the specimen is 17 mm.; the diameter of the upper surface 7 mm.

The main skeleton is a sub-isodictyal reticulation of styli in loose bundles, held together at the nodes by a very small quantity of spongin. Over the lateral surface of the sponge there is a dermal skeleton, composed of a loose, irregular reticulation of single styli lying horizontally. On the upper surface the arrangement is quite different, the dermal membrane being supported on radiating brushes of styli which are much smaller than those of the general skeleton, and being devoid of the larger styli which occur lying horizontally, as above described, over the lateral surface.

Spicules:—(1) Fairly stout, slightly curved styli or subtylostyli; narrowing slightly towards the base, gradually and sharply pointed at the apex; measuring about 0·39 by 0·016 mm.

(2) Smaller styli of the subdermal brushes beneath the upper surface; straight or nearly so; narrowing slightly towards the base, which may be faintly subtylote; sharply and fairly gradually pointed at the apex; measuring about 0·25 by 0·009 mm.

(3) Minute palmate isochelæ, ranging in length from 0·016 mm. down to 0·004 mm. The palms are triangular in front view. These spicules occur in enormous numbers, both in the dermal membrane and in the interior of the sponge.

(4) Large sigmata; slightly contort, fairly stout, measuring about 0·1 mm. from bend to bend. Rather scarce. A very few small sigmata also occur.

(5) Toxa; very strongly curved in the middle, like the curve of a hair-pin, then

very widely spreading, with slightly reflexed, minutely spined ends; measuring, say, about 0·2 mm. in a straight line from end to end by 0·0027 mm. in diameter near the middle. Rather scarce; a few short, smooth toxa also occur.

The sponge contains a certain number of foreign spicules, and it is difficult to be quite certain that the sigmata and toxa really belong to it, but I have little doubt they do, especially the toxa.

This very interesting species appears to be closely related to Topsent's *Esperiopsis columnata* [1892] from the North Atlantic.

Register No., Locality, &c.—XLVII. 9; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

56. *Desmacella vestibularis* (Wilson).

Tylodesma vestibularis, Wilson [1904].

This species occurs extensively encrusting specimens of four species of Stellettidæ, viz. *Stelletta columna*, *S. crater*, *Ancorina stalagmoides* and *Asteropus simplex*, as described in connection with those species. The crust ranges from about 1·5 to 3·5 mm. in thickness, and is penetrated either by the outer ends of the megascleres of the Stellettid or, in the case of *Asteropus simplex*, by an invasion of the general skeleton. The vents are small and scattered, and rather slit-like, and appear, in some cases at any rate, to serve also as exhalant apertures for the Stellettid.

The main skeleton consists of tylostyli, for the most part loosely and irregularly scattered, but collecting together in radial bundles towards the surface, which is protected by a thick pile of radiate spicule brushes.

Spicules:—(1) Tylostyli; usually slightly curved near the base; with well-developed spherical heads; gradually and sharply pointed at the apex; varying greatly in size, from about 0·14 by 0·006 to about 0·63 by 0·012 mm.

(2) Sigmata; simple and contort, varying from about 0·01 to 0·044 mm. from bend to bend.

I think there can be no doubt that this species is identical with the sponge described by Wilson under the name *Tylodesma vestibularis* from a depth of 53 fathoms amongst the Galapagos Islands, on the opposite side of the Pacific Ocean. A number of encrusting or so-called parasitic species of *Desmacella* have, however, been described, and I am by no means sure that Wilson's species may not be identical with some one or other of those previously known. Evidently this thinly encrusting type of *Desmacella* is very widely distributed. I have referred on previous pages to the possibility of the existence of a true commensalism between the *Desmacella* and the sponge on which it is growing. It is obvious that there must be some mutual accommodation between the canal-systems of the two species, but probably the association is by no means obligatory.

Previously known Distribution.—Galapagos Islands (Wilson).

Register Nos., Locality, &c.—Growing on *Stelletta crater*, R. N. XXXII. 2, 15,

16, Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms, and R. N. L. 9, Station 134, Spirits Bay, near North Cape, New Zealand, 11–20 fathoms; and on *Stelletta columna*, R. N. XXXII. 4, Station 96, as above; and on *Ancorina stalagmoides*, R. N. XXXIII. 1, 6, off Three Kings Islands, N. of New Zealand; and on *Asteropus simplex*, R. N. XXXII. 11, Station 96.

57. *Biemna novæ-zealandiæ*, n. sp. (Pl. XIV, figs. 1–4.)

This species is represented by a rather thin, white crust, on what looks like a shell fragment partially embedded in a dry specimen of *Ancorina stalagmoides* (R. N. XXXIII. 1). The main skeleton has a rectangularly reticulate appearance under a pocket-lens, where the surface has been removed, with stouter primary spicular fibres and slender secondaries. The dermal skeleton is too much injured for description, but there are indications of a stellate arrangement of spicules.

Spicules:—(1) Styli (Pl. XIV, fig. 1); stout, slightly curved, especially towards the base, which is evenly and broadly rounded; measuring up to about 1·07 by 0·032 mm., but often much slenderer.

(2) Large sigmata (fig. 2); C-shaped or slightly contort; with short, sharp, incurved extremities; measuring from about 0·056 to about 0·14 mm. from bend to bend and about 0·004 mm. thick; sometimes in sigmodragmata.

(3) Small sigmata (fig. 4); C-shaped, very slender, about 0·02 mm. from bend to bend, or less.

(4) Microxea (fig. 3); straight, fusiform, gradually and finely pointed at each end; measuring about 0·096 by 0·003 mm.; scattered singly or in dragmata.

(5) Microxea; very much smaller than (4) but of much the same form; about 0·02 mm. long; comparatively few, scattered and in dragmata.

(6) Slender rhaphides; hair-like; about 0·12 mm. long, or perhaps more; scattered and in dragmata.

The larger sigmata and microxea are enormously abundant.

The species is evidently nearly related to *Biemna trirhaphis*, Thiele [1903 B] (= *Desmacella peachi*, var. *trirhaphis*, Topsent [1897]) and to *Biemna megalosigma*, Hentschel [1912], but it differs in details of spiculation.

Register No., Locality, &c.—XXXIII. 1. *a*; off Three Kings Islands (or off North Cape ?), New Zealand.

58. *Biemna* sp.

A second and quite distinct species of *Biemna* is represented by some small fragments removed by Mr. Row from the block of black basalt (R. N. XXXV) and mounted in balsam. It differs from *B. novæ-zealandiæ* chiefly in the absence of microxea and the more strongly curved form of the larger C-shaped sigmata. The trichodragmata of hair-like rhaphides are more numerous. It is evidently closely

related to *Biemna chilensis*, Thiele [1905] and *B. macrorhaphis*, Hentschel [1914], but is too fragmentary for specific identification.

Register No., Locality, &c.—XXXV. *e*, *x*; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

Sub-family ECTYONINÆ.

Section *Iophoneæ*.

Genus Iophon, Gray [1867], *emend.*

Sponge soft and crumbling, usually dark coloured in spirit. Main skeleton a reticulation of loose spicule fibre or of single spicules, usually acanthostyles but sometimes smooth; echinated by accessory acanthostyles. Dermal skeleton a reticulation of secondary diacts (tylota, &c.). Microscleres palmate anisochelæ (with the small end usually spurred) and bipocilla.

The type of Gray's genus *Iophon* is Bowerbank's *Halichondria scandens*, which is clearly shown by the description and illustrations of that author to be a species with echinating acanthostyles. Ridley and Dendy, in their "Challenger" Report [1887], failed to distinguish such species from those without echinating spicules. Topsent [1891, 1893] pointed out the desirability of such distinction, but unfortunately proposed his genus *Pocillon* with a type-species (*Isodictya implicita*, Bwk. = *I. hydmanni*, *fide* Stephens [1912]) which has echinating acanthostyles, reserving *Iophon* for species without echinating (accessory) acanthostyles. In this respect he has been followed by Lundbeck [1905].

Nothing could be much clearer than that *Pocillon* is a synonym of *Iophon* and must be abandoned in favour of the latter. The group of species without echinating spicules is thus left without a generic name, and to rectify this omission I propose the genus *Iophonopsis*, with *I. nigricans*, the second species of Gray's genus *Iophon*, as the type.

59. *Iophon lævistylus*, n. sp. (Pl. X, fig. 1, *a*.)

This species is represented by a small sponge (Pl. X, fig. 1, *a*) attached to the type-specimen of *Clathria scotti* (R. N. LII). It appears exactly like the terminal portion of one of the branches of the latter, except for its darker brown colour and smoother surface. It is oval in transverse section and measured, before cutting, about 7 mm. in length by 4 mm. in longer transverse diameter. The texture is rather firm and fairly tough.

The main skeleton is a sub-isodictyal reticulation of smooth styli, with irregularly triangular meshes, rather sparsely echinated by acanthostyles. The sides of the meshes are pluri- or multi-spicular, and of one spicule's length. There is a dermal skeleton of tylota, irregularly scattered in the dermal membrane, where they tend to form a network. Spongin is not conspicuous, but I think there must be a little at the nodes of the main skeleton.

Spicules:—(1) Smooth styli; slightly curved towards the base, which is slightly narrowed and faintly subtylote; gradually sharp-pointed at the apex; size about 0·32 by 0·012 mm.

(2) Acanthostyli; straight, tapering gradually from base to finely pointed apex; spines small, sharp, curved, abundant at the base and diminishing in numbers towards the smooth apex; size about 0·136 by 0·012 mm. (at base, including spines).

(3) Tylota; slightly curved, tapering towards each end, with small, slightly spined heads; size about 0·264 by 0·008 mm.

(4) Palmate anisochelæ of the usual *Iophon* type, with small end spurred; ranging up to about 0·028 mm. in length. Very numerous.

(5) Bipocilla; of quite ordinary form but only about 0·008 mm. in length. Very numerous.

So far as I am aware this is the only species of *Iophon* as yet known with perfectly smooth styli for principal spicules. It brings out very sharply the distinction between the echinating spicules and those of the main skeleton, which was ignored in the "Challenger" Report on the Monaxonida.

Register No., Locality, &c.—LII. *a*; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

Genus Iophonopsis, n. gen.

Sponge soft and crumbling, usually dark coloured in spirit. Main skeleton a reticulation of loose spicule fibre or of single spicules, usually acanthostyles but sometimes smooth (?), not echinated by accessory acanthostyles. Dermal skeleton a reticulation of secondary diacts (tylota, &c.). Microscleres palmate anisochelæ (with the small end usually spurred) and bipocilla.

I regard Bowerbank's *Halichondria nigricans* as the type-species of this genus and *H. pattersoni* as another species. In the latter the characteristic bipocilla evidently tend to disappear, and they are not mentioned by Bowerbank.

60. *Iophonopsis* sp.

This species is represented by some fragments of rather dark brown colour, very soft and crumbling texture, and a characteristic honeycombed appearance. The largest measures about 30 by 17 by 12 mm. and looks like part of a lobose specimen, with a rounded margin bearing a row of three vents, of which the largest is about 4 mm. in diameter, each the opening of a cylindrical oscular tube. The substance of the sponge is made up of a meshwork of trabeculæ with rounded canals between them, the ends of these canals, at the surface, being covered by the thin, translucent, finely reticulate dermal membrane.

The main skeleton is a sub-isodictyal reticulation of acanthostyles, with triangular meshes whose sides are made up each of from one to about four spicules. There is no fibre, no recognisable spongin, and no echinating spicules. The dermal

skeleton is very feebly developed, consisting of slender tylota, scattered or in loose wisps and fibres.

Spicules:—(1) Acanthostyli; very slightly curved; abundantly spined but more so towards the base and apex than in the middle; the spines are small, sharp, conical; the apex is short, conical, sharp-pointed and smooth; size about 0·02 by 0·016 mm., including spines.

(2) Secondary diacts of the dermal skeleton; long and slender, nearly straight; usually tylote, with irregularly spined ends; size about 0·2 by 0·005 mm.

(3) A very few minute, palmate anisoschelæ have been observed, about 0·016 mm. long, but so small and rare that no satisfactory account can be given of them.

(4) A very few minute bipocilla, about 0·008 mm. long, have also been seen, apparently in a vestigial condition.

This species comes very near to *I. pattersoni*, and may be merely a variety thereof, with both chelæ and bipocilla vestigial. At any rate it does not seem desirable to propose a new specific name until more material is forthcoming.

Register No., Locality, &c.—L. 2; Station 134, Spirits Bay, near North Cape, New Zealand, 11–20 fathoms.

Section *Clathrieæ*.

61. *Bubaris oxeata*, n. sp. (Pl. XIV, figs. 20 and 21.)

This species is represented by two or three thin crusts attached to the block of black basalt (R. N. XXXV) so often referred to, the type (R. N. XXXV.*f*) being about 21 mm. in maximum diameter. There are abundant remnants of a thin dermal membrane, of a dark brown colour, supported on the ends of the projecting styli. The soft tissues of the interior are also dark brown.

The skeleton consists of a basal crust of short, interlacing oxea, for the most part disposed horizontally, in which are inserted the bases of very numerous, rather close-set styli of various sizes, which project from the basal crust more or less perpendicularly.

Spicules:—(1) Oxea (Pl. XIV, fig. 21) of the basal crust; more or less bent or angulated, symmetrically or asymmetrically; quite smooth; rather abruptly pointed at each end. Size variable, say about 0·27 by 0·012 mm.

(2) Smooth, stout styli (fig. 20), varying greatly in size, say from 0·289 by 0·0127 to 1·037 by 0·034 mm., or perhaps more; often more or less bent near the broadly rounded base, especially in the smaller forms, otherwise very straight and tapering gradually to the usually sharply-pointed apex.

This species is evidently very closely related to Topsent's *Hymerhabdia oxytrunca* [1904], but in that species the basal spicules are almost always stylote, and only exceptionally oxeote. Topsent considers them as being derived from oxea,

but I am inclined to think that the oxeote condition here shown is secondary and derived from the stylote.

Register Nos., Locality, &c.—XXXV. *f, h, u*; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

62. *Bubaris elegans*, n. sp. (Pl. X, fig. 5; Pl. XIV, figs. 22–24.)

The single specimen (Pl. X, fig. 5) consists of a cylindrical stalk, attached below by a slightly expanded base to a fragment of calcareous débris, and dichotomising above in two places, so that there are three terminal branches. The branches are slightly swollen but drawn out apically into conical points. The surface of the sponge has a slightly but characteristically woolly appearance, due to the slight projection of the ends of the radial skeleton columns, but this diminishes towards the stem, which is nearly smooth. There are no recognisable vents or pores. The entire sponge has a very stiff, erect appearance. The total height is 42 mm.; length of stem 14 mm., diameter 2 mm.; length of terminal branches about 12 mm., diameter 3 mm. The colour in spirit is white, the texture stiff and tough, but flexible and elastic.

The skeleton consists in the first place of a dense central axis. In the branches this occupies up to about one-third of the total diameter. In the stem, which I have purposely avoided cutting, it probably occupies much more. In this axis the spicules are so closely packed that it is very difficult to make out their exact form, but they seem to be a mixture of the types described below, with long, straight styli lying lengthwise in the middle and shorter bent styli and oxea towards the surface, variously orientated. From the central axis thus constituted come off almost at right angles short, stout, densely plumose columns or brushes of spicules, the ends of the terminal spicules projecting beyond the surface, but now mostly broken short. These columns again consist of long, straight styli and comparatively short, bent spicules.

Spicules:—(1) Shorter styli and oxea (figs. 23 and 24); more or less bent, gradually sharp-pointed at the one end and ranging from broadly rounded to gradually sharp-pointed at the other, as shown in the figures; size about 0·27 by 0·012 mm., sometimes rather less.

(2) Long styli (Pl. XIV, fig. 22); straight or slightly bent, characteristically narrowed at the base, gradually and sharply-pointed at the apex; size about 0·55 by 0·015 mm.

The different types are connected by intermediate forms and sizes.

This species has a good deal in common with Topsent's *Bubaris sosia* [1904], especially as regards external form, but differs widely in the character of the axial spicules, which in *B. sosia* are vermicular strongyla. It agrees with my *B. oxeata* (from the same locality as *B. elegans*) in the general features of the spiculation, but the long styli of *B. oxeata* attain a much larger size and do not exhibit the narrowing

at the base so characteristic of *B. elegans*. *B. oxeata* is an encrusting species and, though evidently specifically distinct from *B. elegans*, seems to stand in much the same relation to the latter as *B. vermiculata* to *Axinella erecta*. The spiculation of *Bubaris elegans* is more Axinellid than that of *Axinella erecta*, and the species seems to afford an easy transition between the two genera.

Register No., Locality, &c.—XLI; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

63. *Bubaris ornata*, n. sp. (Pl. XIV, figs. 25–27.)

The single specimen forms a thin crust of a pale brownish colour and about 7 mm. in breadth, upon the block of black basalt (R. N. XXXV). It lies close to the large crust of *Bubaris vermiculata*, from which it is indistinguishable in external appearance.

The skeleton consists of a dense basal mass of felted acanthostrongyla, from which springs a dense forest of styli and acanthostyli with outwardly directed apices.

Spicules:—(1) Acanthostrongyla (Pl. XIV, fig. 27); abundantly but minutely spined; more or less curved or angulated, the bend usually occurring about the middle; often slightly tylote; varying a good deal in size and proportions, e. g. 0·068 by 0·01 mm., 0·136 by 0·008 mm., 0·124 by 0·0067 mm.

(2) Acanthostyli (fig. 26); usually more or less sharply bent near the broadly and evenly rounded base, tapering gradually to the finely pointed apex; spines minute but abundant, commonly absent from the apical portion; size variable, say about 0·172 by 0·01 mm.

(3) Smooth styli (fig. 25); nearly straight, with broadly rounded base and tapering gradually to the finely pointed apex; size about 0·372 by 0·014 mm. (possibly much longer in some cases).

(2) and (3) are connected by intermediate forms.

The acanthostrongyla of this interesting species suggest a relationship with the genus *Plocamia*, but I have found no microscleres.

Register No., Locality, &c.—XXXV. *o*; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

64. *Bubaris vermiculata* (Bowerbank).

> *Hymeraphia vermiculata*, Bowerbank [1866, 1874]; *Bubaris vermicularis*, Gray [1867]; *Hymeraphia vermiculata*, Carter [1876]; *Bubaris vermiculata*, Thiele [1903 A]; *Bubaris vermiculata*, Topsent [1891, 1904]; *Bubaris vermiculata*, Stephens [1921].

This well-known and widely distributed species is represented in the collection by a thin but very extensive crust, up to about 80 mm. in breadth, growing upon the block of black basalt, R. N. XXXV; and by one or more smaller crusts, associated with it on the same stone. I have compared the spiculation with

"Porcupine" specimens of the encrusting form in Mr. Carter's cabinet and find no difference except that the vermiform spicules of the basal layer are much more robust in the New Zealand example. Topsent, however, has shown how much these vary in size in specimens from the Azores. Over considerable portions of the large crust the hispidating styli have either never developed or been rubbed off, so that the crust consists only of the vermiform spicules densely interwoven into a coherent mass.

Previously known Distribution.—North Atlantic, British Seas, Azores, &c. (Bowerbank, Carter, Topsent, Stephens). Var. *erecta* also from Gulf of Manaar (Carter) and South Atlantic and Southern Ocean (Ridley and Dendy).

Register No., Locality, &c.—XXXV. *a*, *p*; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

65. *Clathria scotti*, n. sp. (Pl. X, fig. 1; Pl. XIV, figs. 5–8.)

There are four specimens of this sponge in the collection, all from the same locality and all closely resembling one another in appearance. The largest and most perfect (Pl. X, fig. 1) may be regarded as the type. It has a well-developed, stout main stalk which divides and subdivides into irregular branches, which anastomose with one another at wide intervals and tend to lie, in very straggling fashion, in one plane. The branches are rather slender, somewhat flattened, and ragged in outline, and where a number join together they form flat, fenestrated, rugose expansions. The unbranched main stem is about 45 mm. in height by 8 mm. in diameter; the branches average about 5 mm. in diameter, and the total height of the specimen is about 210 mm. The colour in spirit is light brown and the texture compressible, tough and elastic, with harder stem.

The skeleton is a very irregular reticulation of horny fibre, cored by the stout, smooth styli and abundantly echinated by the acanthostyles. Some of the first-mentioned spicules project in sparse brushes from the surface of the sponge, where there are also sparse, irregular brushes of slender tylostyles.

Spicules:—(1) Stout styli (Pl. XIV, fig. 5); entirely smooth, slightly curved, especially towards the base, which is evenly rounded off or subtylote; gradually and sharply pointed at the apex; size about 0·527 by 0·025 mm.

(2) Acanthostyles (fig. 7); short, straight, tapering gradually from base to sharply pointed apex; thickly covered almost to the apex with small, conical spines, which are thorn-like and curved, those on base and shaft pointing in opposite directions (towards one another); size about 0·1 by 0·016 mm. (including spines), without much variation.

(3) Slender, straight (or nearly straight), entirely smooth tylostyli or subtylostyli (fig. 6); usually with rather fully developed, oval heads; gradually and sharply pointed at the apex; measuring up to about 0·36 by 0·006 mm.

(4) Toxa (fig. 8); long, slender, hair-like, with very open angle, so that the two

limbs tend to lie in the same straight line; length up to about 0·5 mm.; often associated in loose bundles.

The soft tissues contain numerous short chains of highly refractive granules, probably Schizophyta.

Of the numerous species of *Clathria* (including *Rhaphidophlus*) already known, this species, perhaps, comes nearest to Whitelegge's [1907] *Rhaphidophlus tenebratus* from New South Wales, from which it differs chiefly in the absence of the isochelæ; but Whitelegge's figured specimen is a very poor one. I have ventured to name the species after the distinguished explorer whose name will ever be associated with Antarctic discovery.

Register No., Locality, &c.—LII (four specimens); Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

66. *Clathria terræ-novæ*, n. sp. (Pl. XII, fig. 5; Pl. XIV, figs. 9–13.)

The external form of this sponge (Pl. XII, fig. 5) is very characteristic. From a short, erect stem arises a bushy mass of slender branches, giving off longer or shorter lateral branches, which anastomose with one another pretty freely. The branches are usually sub-angular or slightly flattened, and many of the lateral branches are so short as to appear as mere knobs, giving the main branches a nodose appearance. The freely projecting terminal portions of the branches are rather short, and rounded or bluntly pointed. R. N. V. 2 is the most perfect of the three specimens, in that the stem has not been cut off from the base of attachment, as it has been in R. N. V. 3, which is more bushily branched and altogether more beautiful. The total height of the former specimen is about 160 mm., and the greatest breadth about 90 mm. The main stem is about 24 mm. in height and 7 mm. in diameter, scarcely expanding at the base. The diameter of the branches is about 3 mm. The colour in spirit is light brown; the texture tough, compressible and elastic, with harder stem. The surface is very minutely hispid. Vents and pores are not recognisable externally.

The skeleton consists of ascending, plumose columns of larger and smaller acanthostyles; the main columns lie in or near the middle of the branch and anastomose with one another to some extent, while giving off obliquely ascending secondary columns towards the surface. The main columns contain a very large amount of brown-coloured, laminated spongin, in which the bases of the spicules are more or less deeply implanted. The spongin gradually diminishes in the secondary columns as they approach the surface, where their ends mingle with somewhat sparse dermal brushes of slender tylostyles.

Spicules:—(1) Large, stout, basally spined acanthostyles (Pl. XIV, fig. 9); more or less, but usually only slightly, curved; smooth except at the base, which is thickly covered with small, conical spines; tapering gradually to sharply-pointed apex; measuring up to about 0·6 by 0·024 mm.

(2) Small acanthostyles (fig. 10); slightly curved, tapering gradually to sharply pointed apex; base sometimes subtylote, thickly covered with small, thorn-like spines curved towards the shaft; shaft rather sparsely covered with sharp, thorn-like spines recurved towards the base, more sparsely developed in the neighbourhood of the base and of the apex; size variable, from about 0·12 by 0·017 to about 0·36 by 0·025 mm. (including spines). The larger ones (fig. 10 *a*) may be regarded as constituting a transition between (1) and (2), but the distinction between the two categories remains pretty sharp.

(3) Straight, slender tylostyli (fig. 11); with small heads, which commonly show a faint trace of spination; gradually and sharply pointed at the apex; size variable, up to about 0·4 by 0·008 mm.

(4) Toxa (fig. 12); short and rather stout; angle very various; often very contort; often with slightly spined or roughened apices; length, say, about 0·08 mm.

(5) Palmate isochelæ (fig. 13); of the usual *Clathria* type, but very minute and slender, and easily overlooked owing to their sporadic distribution; length about 0·008 mm.

This is one of those species which in spiculation and skeleton arrangement make a near approach to the genus *Microciona*, but its mode of growth is that of a typical *Clathria*.

Register No., Locality, &c.—V. 1-3; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

67. *Raspailia topsenti*, n. sp. (Pl. XII, fig. 4; Pl. XIV, figs. 14–16.)

The specimen (R. N. II. 1, Pl. XII, fig. 4) which I regard as the type of this species is arborescent; copiously and subdichotomously ramified, with rather short, subcylindrical branches anastomosing with one another pretty frequently, the whole branch-system tending to expand in one plane and arising from a short, stout, subcylindrical stem. The total height of the specimen is about 176 mm., the maximum breadth about the same; the unbranched stem measures about 35 by 10 mm.; the terminal branches average about 45 by 5 mm. and end bluntly, with hardly any taper. There are no recognisable vents. The surface is granular and very minutely hispid.

Stem and branches alike consist of a stout, horny-looking axis, resembling that of a Gorgonia, and of a dark brown colour in the older parts, surrounded by a layer of soft tissue of a pale greyish colour, which can be readily scraped off, leaving the axis bare.

The axis, in longitudinal or transverse sections, appears at first sight to be composed of an utterly confused, dense interlacement of stout styli; but closer examination shows that it is made up, in part at any rate, of stout longitudinal strands of horny fibre abundantly cored with styli. From this axis close-set spicular fibres, or columns of stout styli, curve upwards and outwards to the surface, where

they terminate in feebly developed tufts of similar styli, associated with which are a few, evidently vestigial, brushes of very slender styli or rhaphides. The outwardly curving spicular columns are not very well defined, and exhibit a slightly plumose character owing to the want of parallelism amongst many of the component spicules. They contain little if any spongin, and are connected with one another by transverse bundles of stout styli, or by single spicules. They are abundantly echinated by the small acanthostyles so characteristic of the genus, which also occur, though less abundantly, in the central axis.

Spicules:—(1) Stout styli (Pl. XIV, fig. 14); more or less curved or bent; entirely smooth; evenly and broadly rounded off at the base; sharply and more or less gradually pointed at the apex; size up to about 0·44 by 0·02 mm.

(2) Slender styli or rhaphides of the dermal brushes (fig. 15); smooth, straight, often of hair-like dimensions, about 0·16 by 0·0013 mm.

(3) Small acanthosubtylostyles (fig. 16); bent near the base like a hockey-stick; tapering very gradually to the apex; the proximal third, or thereabouts, smooth, the distal two-thirds minutely spined, right up to the apex; size about 0·1 by 0·008 mm.

This species probably falls within the limits of Topsent's genus *Raspaxilla* [1913 B], which that author, as I think unnecessarily, separates from *Raspailia*, largely on account of the character and arrangement of the acanthostyles. It is especially interesting because of the vestigial condition of the dermal brushes of slender styli, which seem to be entirely absent in the closely allied species, *R. inæqualis*, described below.

In addition to the type-specimen described above, there are in the collection two other much less perfect specimens with rather short branches and vestigial brushes of slender dermal spicules. One of these (R. N. II. 3) has been almost entirely denuded of the soft tissues and reduced to a hard, stiff, elastic stem with branches coming off in one plane only, so that it makes a close approach to the external appearance of *R. inæqualis*, though the branches, so far as can now be ascertained, are all short. Neither of these specimens exhibits any anastomosis of the branches, but I think they may both be regarded as belonging to the species described above.

Register Nos., Locality, &c.—II. 1–3; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

68. *Raspailia inæqualis*, n. sp. (Pl. XII, fig. 1; Pl. XIV, figs. 17–19.)

There is a single very fine specimen of this remarkable sponge (Pl. XII, fig. 1). The subcylindrical stem, slightly expanded below in a base of attachment, is about 72 mm. high by 8 mm. in diameter. The branching is almost regularly dichotomous, and the branches, whose proximal portions are very distinctly flattened, are spread out all in the same plane, entirely without anastomosis. The terminal branches vary greatly in length, some being quite short while others are very long and slender. Thus one of two branches formed by the same bifurcation measures only about

35 mm. in length, while the other measures no less than 305 mm., becoming cylindrical and quite slender distally. The main branches measure about 8 mm. in breadth by 5 mm. in thickness, and the slender, cylindrical, terminal portions of the elongated branches about 3·5 mm. in diameter, tapering to blunt points. The total height of the specimen is about 460 mm. The hard, elastic axis is covered with a rather thin layer of soft tissue having a somewhat velvet-like texture, with very minutely hispid, granular-looking surface. The colour in spirit is greyish. There are no recognisable vents.

The solid axis occupies about two-thirds of the longer diameter, and about one-third of the shorter diameter of the flattened branches. At first sight the spicules appear to lie in it without order, pointing in all directions; but closer examination shows that there is really a dense network of horny fibre, mostly longitudinal, in which the individual fibres are cored by smooth, slender styli, and echinated to a slight extent by acanthostyles, though the spination of these spicules is here so slight as to make it difficult to recognise them in the confused mass. From this central axis numerous close-set spicular columns radiate almost at right angles to the surface of the sponge, where they terminate in well-developed brushes of stout styli. The axes of these columns are made up of similar or more slender styli, and they are echinated in a plumose fashion by the acanthostyles. The columns also branch occasionally, and are irregularly connected with one another by transverse spicules or spicule-bundles. The bases of the columns may be deeply embedded in the solid axis, which evidently extends in between them as thickening of the branch progresses.

Spicules:—(1) Large, stout styli (Pl. XIV, fig. 17); more or less curved or bent; entirely smooth; broadly and evenly rounded off at the base; tapering gradually to a sharply or bluntly pointed apex; size about 0·37 by 0·017 mm. (may be rather longer and slenderer, e.g. 0·476 by 0·014 mm.).

(2) Smooth styli (fig. 18); similar to the above, but smaller, and especially more slender; measuring, say, about 0·22 by 0·0053 mm., but very variable; characteristic of the interior of the sponge. A few oxea occur amongst them.

(3) Acanthostyles, or subtylostyles (fig. 19); more or less bent towards the base; tapering very gradually to the sharply-pointed apex; the proximal third, or thereabouts, smooth, the distal two-thirds very minutely spined right up to the apex; measuring, say, about 0·132 by 0·008 mm. These spicules seem sometimes entirely to lose their spination and pass into (2).

I at first thought that this species must be regarded as a mere variety of *Raspailia topsenti*, the single specimen coming from the same station as the specimens of the latter, and closely resembling them in most respects. In distinguishing the two I lay particular stress upon the complete absence in *R. inæqualis* of the vestigial dermal tufts of very slender styli which characterise *R. topsenti*. In this respect *R. inæqualis* agrees with Hallmann's genus *Echinaxia* [1917 B], which, together with *Raspaxilla*, I should include in *Raspailia*. Other features by which the two New

Zealand species may perhaps be distinguished from one another are the great elongation of some of the branches in *R. inæqualis* and the much smaller size, and especially more slender character, of the majority of the smooth styli.

Register No., Locality, &c.—II. 4; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

69. *Rhabderemia coralloides*, n. sp. (Pl. XII, fig. 3; Pl. XV, figs. 1–4.)

There are three pieces of this sponge in the collection, which may all have belonged to the same specimen. The largest (Pl. XII, fig. 3) is a mass of irregular, subcylindrical, anastomosing branches, resembling a Madrepore. The entire mass is about 120 mm. in maximum diameter. The individual branches are about 12 mm. in diameter; they anastomose with one another at short intervals, the terminal portions ending bluntly and not projecting far. The surface of the sponge is granular from the slight projection of the ends of the primary lines of the skeleton. It is also characteristically marked by shallow, branching grooves, about 1 mm. in width. These grooves rarely anastomose, but their branches converge and meet at points where, in life, vents must have been situated. They are still covered with a thin, translucent dermal membrane, and are doubtless superficial exhalant canals. Numerous small openings occur in their floors. The texture of the sponge is very firm and compact; scarcely compressible, but rather friable. The colour in spirit is pale greyish yellow.

The skeleton is a very compact reticulation of spicular fibre, or, better, of spicule-bundles, or even single spicules, in which the side of the mesh is of only one spicule's length. In the interior the meshes are usually triangular, but more externally there is a well-marked tendency to form quadrangular meshes with stouter primary skeletal lines radiating to the surface, where their ends give rise to the small papillæ or granules above mentioned. There is no special dermal skeleton, the thin dermal membrane, which covers the general surface of the sponge as well as the superficial exhalant canals, containing only microscleres. There is no visible spongin.

Spicules:—(1) Acanthostyles (rhabdostyles) (Pl. XV, fig. 1); stout; straight, except towards the base, which is abruptly bent to one side and broadly rounded off without enlargement; apex sharply and fairly gradually pointed. The proximal third, or thereabouts, of the spicule is smooth, the distal two-thirds are covered with small, sharp spines. Young, slender examples (fig. 1 *a*) are completely smooth, the spines only appearing as the spicule approaches its full size, which is exactly the opposite of what Topsent [1896] describes for his *Rhabderemia spinosa*. Fully grown examples measure about 0·34 by 0·034 mm., including the spines.

(2) Microstyles (fig. 2); very small and slender; usually slightly curved towards the base; tapering very gradually to the finely-pointed apex; perhaps very slightly

roughened; size about 0·04 by 0·002 mm.; enormously abundant in the interior of the sponge, scarce in the dermal membrane.

(3) Microxea (fig. 4); with a more or less developed kink in the middle (the "thraustoxea" of Topsent); smooth and fairly stout; sharply pointed at each end; about 0·032 mm. in length (from apex to apex) by 0·0026 mm. in thickness in the middle. These occur at or near the surface, but they are comparatively scarce and seem to pass by intermediate forms and sizes into

(4) Sigmata (fig. 3); very much contorted, often twisted into the form of calipers; slender; greatest length in a straight line only about 0·008 mm.

This is by far the most robust species of *Rhabderemia* as yet described, the others being mostly thinly encrusting forms. Whitelegge's *Sigmaxinella mammillata*, however, for which Hallmann has proposed the genus *Rhabdosigma*, is a robust form evidently closely related to *Rhabderemia* [*vide* Hallmann, 1917 A].

The New Zealand species described above combines the spicular characters of several of the others in an interesting way. Thus it has the "thraustoxea" of *R. guernei*, the type of the genus [Topsent, 1892], and the spiny rhabdostyles of *R. spinosa* [Topsent, 1896], and altogether an unusually complete spiculation.

Register No., Locality, &c.—XIII; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

Section *Hymedesmieæ*.

70. *Hymedesmia lundbecki*, n. sp. (Pl. XIV, figs. 28–30 *c*.)

The single specimen (dry) forms a dark brown crust (lighter on the surface) attached chiefly to an encrusting Polyzoon growing on the block of black basalt, R. N. XXXV. The maximum diameter of the crust is about 16 mm., the thickness about 1 mm. The surface is almost smooth, not hispid but finely granular. There are no recognisable vents.

The skeleton consists chiefly of very stout but short columns of densely packed strongyla, arranged almost vertically and supporting the dermal membrane. There are very few acanthotylostyles and it is impossible to make out their arrangement. The dermal membrane is densely packed with the large isochelæ, which also occur scattered in the subjacent tissues.

Spicules:—(1) Acanthotylostyles (Pl. XIV, fig. 28); rather irregular in form; straight or nearly so; with well-developed, subspherical heads and sharp or blunt apices; spination very irregular, confined to the head and adjacent part of the shaft. These spicules have been measured from 0·25 to 0·47 by 0·012 mm. They are apparently not differentiated into two distinct size-categories.

(2) Strongyla (fig. 29); straight or slightly curved, more or less distinctly polytylote; bluntly rounded off at each end; usually somewhat narrower at one end than at the other; typical size about 0·6 by 0·012 mm.

(3) Tridentate isochelæ (figs. 30 *a*–30 *c*); large and stout, with very strongly

curved shaft and very short, semicircular teeth. Length (in a straight line) 0·06 mm.; thickness of shaft in side view 0·008 mm.

This species belongs to the group with very strongly curved isochelæ and with strongyla, and is closely related to *H. koehleri*, *H. lacera*, *H. curvichela*, and *H. similis* as described by Lundbeck [1910], and to *H. helgæ*, Stephens [1916, 1921]. It is, however, distinguished by details of spiculation which can be readily made out by comparison with the published descriptions and figures of the above-mentioned species. Amongst these details the small size of the acanthotylostyles in comparison with the strongyla, together with their rarity and irregularity, are perhaps the most noteworthy. I have much pleasure in naming the species after Dr. Will. Lundbeck, who has contributed more than any one else towards our knowledge of the large and interesting genus *Hymedesmia*, and has given [1910] a most useful key to the then-known species, about seventy in number.

Register No., Locality, &c.—XXXV. *c*; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

Section *Myxilleæ*.

71. *Anchinoë fristedti*, n. sp. (Pl. XV, figs. 5–8.)

The single specimen is an irregular mass of anastomosing trabeculæ. The surface is very uneven, covered with small conuli except in places where the thin, smooth, translucent dermal membrane stretches uninterrupted over a considerable extent. Vents? Texture soft and resilient. Colour now quite black, evidently stained with osmic acid. The specimen measures about 46 by 30 by 20 mm.

The skeleton is by no means typical. It consists primarily of plumose columns of acanthostyles (large and small), but instead of being cored by smooth diacts these columns either have no special axis at all or are based upon foreign matter, chiefly Gorgonia spicules, of which the sponge contains a large quantity. In some places it looks as if the acanthostyles were merely echinating a network of foreign matter, in others true plumose columns are present. The dermal membrane contains many of the smaller acanthostyles lying tangentially, along with a profusion of isochelæ, with loose, subdermal wisps and strands of slender tornota (or subtylota).

Spicules.—(1) Large acanthostyles (Pl. XV, fig. 5); slightly bent towards the base, which is evenly rounded off and abundantly spined, the spines rapidly dying away towards the apex, so that by far the greater part of the spicule is almost or quite smooth; tapering gradually towards the apex, which is sharply pointed. Size about 0·43 by 0·025 mm. (at base, including spines).

(2) Small acanthostyles (fig. 6); straight, entirely and richly spined, except for the extreme apex, which is gradually and sharply pointed; widest at the base; size about 0·084 by 0·016 mm. including spines.

These two types of acanthostyles are sharply distinguishable, though intermediate forms are not altogether wanting.

(3) Tornota (or subtylota) (fig. 7); straight, slender, entirely smooth; slightly asymmetrical, being rather thicker at one end than at the other; size about 0.216 by 0·004 mm.

(4) Tridentate isochelæ (chelæ arcuatæ) (fig. 8); of quite ordinary form and about 0·024 mm. long.

A very few sigmata have been observed, which are very likely foreign.

Register No., Locality, &c.—XIX. 7; Station 90, near Three Kings Islands, 100 fathoms.

72. *Anchinoë novæ-zealandiæ*, n. sp. (Pl. XII, fig. 2; Pl. XV, figs. 9–11.)

The single specimen (Pl. XII, fig. 2) is erect, flabellate, with a short, thick stalk, expanding nodosely below. The lamina is slightly proliferous, with slight indications of a clathrous character. The two surfaces are essentially similar, marked by shallow, meandering grooves separated by rows of low conuli usually united to form ridges, the whole covered by a rather thick, translucent, subglabrous dermal membrane. Pores and vents inconspicuous; a few small, round apertures in the dermal membrane on both sides may represent the latter. Texture compressible and elastic, tough and fibrous. Colour in life "bright post-office red," now (in spirit after formalin) light brownish grey with a very slight pinkish tinge. Height 142 mm.; maximum breadth 94 mm.; thickness about 10 mm.

The main skeleton consists of stout, sinuous, plumose columns of spicules, with much spongin, branching and curving outwards towards the surface. These columns lie pretty close together, and are connected here and there by anastomoses. Each consists of a compact, multispicular, axial core of oxea, surrounded by a very thick coating of spongin. The total diameter of the fibre, excluding the projecting apices of the echinating acanthostyles, is about 0·085 mm. (sometimes more). The echinating spicules are very abundant, they usually project from the fibre nearly at right angles and their bases are deeply embedded in the spongin, usually right up against the spicular core. A good many loose megascleres occur scattered in the ground-substance between the fibres, and, at the surface of the sponge, numerous loose brushes of oxea lie more or less at right angles beneath the dermal membrane, with their apices often projecting slightly through it. In the dermal membrane itself numerous acanthostyles are scattered tangentially, so as to form an almost continuous, but thin, crust.

Spicules:—(1) Acanthostyles (Pl. XV, fig. 10); usually slightly curved, abundantly spined except over the sharply-pointed apex; spines small, sharp; measuring up to about 0·15 by 0·014 mm. (inclusive of spines), but usually a good deal smaller; not divisible into distinct categories.

(2) Oxea (tornota) (fig. 9); straight, rather slender, hastately pointed at each end; commonly more abruptly pointed and rather broader at one end than at the other. Size about 0·176 by 0·005 mm.

(3) Tridentate isochelæ (chelæ arcuatæ) (fig. 11); small and rather slender; about 0·016 mm. in length; rather scarce.

Topsent [1913 A] and Stephens [1921] having both agreed to revive Gray's genus *Anchinoë* [1867] it seems almost necessary to follow their example, otherwise I should have referred the present species to Carter's genus *Plumohalichondria*, of which it is a very typical example. The species is evidently very closely related to my *Plumohalichondria clathrodes* from the Indian Ocean [1921]. It seems to differ chiefly in the absence of the larger chelæ and may not be worthy of a distinct specific name.

Register No., Locality, &c.—I; off North Cape, New Zealand, sandy bottom, 30–14 fathoms, August 2nd, 1911.

73. *Myxilla novæ-zealandiæ*, n. sp. (Plate X, fig. 6; Pl. XV, figs. 12–15 *b*.)

Sponge (Pl. X, fig. 6) rather thinly lamellar, very irregular; fenestrate and canaliculate; with very uneven surfaces proliferating into irregular ridges, and with numerous round holes of various sizes, some of which are vents. The fenestrations may be closed by a thin, transparent membrane, which also forms the outer walls of canals which run just beneath the surface and open by circular vents. There are two good-sized fragments from Station 96, which may be parts of the same specimen. There are no recognisable points of attachment and no evidence as to whether the sponge grew erect or procumbent. Each piece measures about 70 by 60 mm., with a very variable thickness, from almost nothing to about 14 mm. There are no well-defined pore-areas and the pores themselves are unrecognisable. The colour in spirit is pale yellowish grey, the texture rather firm and elastic, but somewhat friable.

The main skeleton is a sub-isodictyal reticulation of stout, smooth styli, with irregular meshes of one spicule's length and little or no spongin. There is no well-developed dermal skeleton, but the dermal membrane contains scattered styli like those of the main skeleton and is supported on very loose brushes of slender strongyla.

Spicules:—(1) Stout, smooth styli (Pl. XV, fig. 12), more or less curved; evenly rounded off or very slightly swollen at the base, sometimes slightly polytylote, gradually and fairly sharply pointed at the apex, measuring about 0·47 by 0·02 mm.

(2) Slender strongyla (figs. 13 and 13 *a*); straight, very slightly spined at the extremities, one of which may be subtylote; measuring about 0·24 by 0·008 mm.

(3) Isancoræ spatuliferæ (fig. 14), with three or four long, narrow teeth at each end, very sharply recurved, and not very strongly curved shaft. These spicules vary in length, from about 0·02 to about 0·076 mm., with numerous intermediates.

(4) Minute, slender isochelæ (figs. 15 *a* and 15 *b*), in side view resembling C-shaped sigmata with slightly thickened ends, but really with very small teeth, probably three at each end; length from bend to bend about 0·01 mm.

This species is evidently nearly related to *Myxilla spongiosa*, Ridley and Dendy, obtained by the "Challenger" Expedition from the east coast of South America. The original description of that species mentions only one kind of isochelæ (isancoræ spatuliferæ), but a re-examination of the type-slide shows that both large and small occur and both are numerous, the large measuring about 0·05 mm. and the small about 0·02 mm. in length, with few, if any, intermediates. (At the time when the "Challenger" Report was written the smaller forms of chelæ were commonly regarded as young forms of the larger, which of course they cannot be.) I have seen none but tridentate forms, however, nor have I found any of the minute C-shaped chelæ. Moreover, there are abundant sigmata in *M. spongiosa*, and the smooth styli are much longer, so that there can be no question of specific identity.

Topsent [1901, 1913] has described, under the name *Lissodendoryx* (*Myxilla*) *spongiosa*, var. *asigmata*, an Antarctic form without sigmata, but with only one kind of chela (isancora), so that it, again, cannot be identical with our species.

Lundbeck [1905] has described three species of *Myxilla* with smooth styli, isancoræ spatuliferæ and no sigmata, viz. *M. pedunculata*, *M. diversiancorata*, and *M. pluridentata*, and in the two latter of these the isancoræ have more than three teeth, the number varying from five to seven or eight. These, again, are obviously nearly related to the New Zealand species described above, but still distinct, and none of them seem to possess the very small C-shaped chelæ.

Other species with smooth styli, but with chelæ arcuatæ instead of ancoræ, are included by Lundbeck (*loc. cit.*) in the genus *Lissodendoryx*, which appears to be a synonym of *Hamigera*, Gray, a genus which I have elsewhere [1921] made use of in a wider sense.

Register No., Locality, &c.—XVIII. 2. *a*, *b*; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

Genus Phoriospongia, Marshall [1880].

Myxilleæ in which the proper skeleton is almost completely replaced by sand. Megascleres and microscleres greatly reduced, or even absent.

Messrs. George and Wilson [1919] have proposed to include the genera *Chondropsis* (Carter), Dendy [1895], and *Psammochela*, Dendy [1916 A], in Marshall's Phoriospongia. So far as *Chondropsis* is concerned I am very much inclined to agree with them, though I think *Psammochela* may be conveniently kept apart for the present. When I first revived the genus *Chondropsis* [1895] I pointed out that I had very good evidence of its Ectyonine origin. I must again put forward this view, which has since been strongly supported by the discovery of *Myxilla arenaria*, Dendy [1905], with a highly arenaceous skeleton and reduced megascleres. *Myxilla arenaria*, *Psammochela* and *Phoriospongia* seem to form a natural regression series, but as a similar series of events has probably taken place also in other cases (e.g. in the Collosclerophoreæ, Dendy [1921]) it is impossible to include all the arenaceous

Desmacidonidæ with reduced skeleton even in one and the same section. The genera above referred to may be, provisionally at any rate, included in the Myxilleæ.

74. *Phoriospongia kirkii* (Carter).

Chondropsis Kirkii, Dendy [1916 A].

(For further synonyms and literature *vide* Dendy, *loc. cit.*)

There is in the collection a single very fine specimen (broken into two pieces) of this common Australian species. It forms a large but low, spreading mass of thick, crest-like, proliferous lamellæ, with numerous, large, sphinctrate vents, chiefly on the ridges and other elevated portions. The surface is minutely conulose and also very minutely reticulate or porous. The texture is rather soft and compressible, but resilient. The colour in spirit is yellowish grey.

The main skeleton is a subrectangularly, wide-meshed network of intensely arenaceous fibre, the primary lines being very stout and the secondaries more slender. The dermal skeleton is a polygonally, close-meshed network of similar but more slender fibre, or a layer of sand interrupted by the numerous, usually close-set, small pore-areas, each of which contains perhaps only a single pore.

The spicules are scattered irregularly in the interior between the fibres, the megascleres being straight strongyla, very slender in the deeper parts of the sponge but more robust towards the surface. The microscleres are very slender, small sigmata. Both kinds of spicule are very abundant.

There is a thick but ill-defined, mainly collenchymatous ectosome, more or less granular and with a small amount of fibrous tissue. It is interrupted very frequently by large, irregular, subdermal cavities, which extend into the choanosome and have each a thin roof penetrated by numerous dermal pores. The canal-system is largely lacunar, but with wide oscular tubes having many annular diaphragms. The flagellate chambers are about 0·024 mm. in diameter, subspherical and apparently eurypylous, though the condition of the material makes it difficult to be certain as to the latter point.

This is one of the commonest species of sponge in Port Phillip, and I have recorded thirty-nine specimens in Mr. J. Bracebridge Wilson's collection. It is interesting to find it, with no noteworthy difference, in New Zealand waters.

Previously known Distribution.—Australian Seas (Carter, Lendenfeld, Dendy); Indian Ocean (Okhamandal) (Dendy).

Register No., Locality, &c.—XXXI; Station 134, near Spirits Bay, North Cape, New Zealand, 11–20 fathoms.

Section *Crelleæ*.

Genus Crellomyxilla, n. gen.

The main skeleton is an isodictyal or sub-isodictyal reticulation of acanthostyles, without special echinating spicules and without distinct fibres. The dermal skeleton

is a felt-work of (smaller) acanthostyles lying tangentially in the dermal membrane and more or less supported by brushes of subdermal tornotoxea (or other secondarily diact spicules?). The microscleres are tridentate isochelæ, to which sigmata may be added.

This genus is intermediate between the sections Myxilleæ and Crelleæ of the Ectyoninæ, which I endeavoured to distinguish in my Report on the "Sealark" Sigmatotetraxonida. It is identical with the genus *Myxilla* except for the invasion of the dermal membrane by spiny megascleres, which is the most characteristic feature of the Crelleæ, and it throws considerable light on the origin of the latter group. I include it amongst the Crelleæ because of the character of the dermal skeleton, though as regards the main skeleton it retains the most primitive condition of the Myxilleæ, from which the other genera of Crelleæ have all more or less widely diverged.

75. *Crellomyxilla intermedia*, n. sp. (Pl. XV, figs. 16–21).

This species is represented in the collection by three good-sized pieces (R. N. LV. 5) and three small fragments, all from the same locality and very possibly parts of the same specimen. The sponge consists of elongated, subcylindrical branches about 7 mm. in diameter, some of which are still attached to a main body of compressed, flabellate form, the whole very irregular. Two of the branches are fused together for a considerable distance where they have come into contact with one another side by side. The longest branch, now detached, measures about 75 mm. The surface is uneven, slightly grooved and granular, with a distinct, subglabrous dermal membrane where not rubbed. Vents apparently small and scattered. Pores in irregular, ill-defined groups, not definite pore-areas. Texture firm, compact but friable. The colour of the smaller fragments (in spirit) is white; the three larger pieces have evidently been stained black with osmic acid.

The main skeleton is a compact, sub-isodictyal reticulation of acanthostyles, with triangular meshes whose sides are formed either by single spicules or by bundles of two or three. No echinating spicules can be found and there is no recognisable spongin. The dermal skeleton is a very dense felt-work of tangentially disposed acanthostyles, for the most part much smaller than those of the main skeleton, partly supported on feebly developed subdermal brushes of tornotoxea.

Spicules:—(1) Acanthostyli of the main skeleton (Pl. XV, fig. 16); usually slightly curved, abundantly and uniformly covered with small, sharp spines, except for the short, smooth, sharp-pointed apex. The base is not tylote and is rather more richly spined than the shaft, the spines tending to be recurved. Size about 0·22 by 0·017 mm. including spines.

(2) Acanthostyli of the dermal skeleton (fig. 18); similar to the above but more strongly curved and measuring only about 0·1 by 0·012 mm., including spines. These

spicules are sometimes distinctly narrowed towards the base, thus showing a tendency to become oxeote.

(3) Tornotoxea (fig. 17); slightly crooked, perfectly smooth, sharply and abruptly pointed at each end, size about 0·21 by 0·007 mm.

(4) Tridentate isochelæ (isancoræ spatuliferæ) (fig. 19); of ordinary form, about 0·028 mm. in length. Not very numerous.

(5) Small tridentate isochelæ (isancoræ spatuliferæ) (fig. 20); about 0·016 mm. in length, but variable. Very abundant.

(6) Sigmata (fig. 21); of ordinary form, rather slender, more or less contort, measuring about 0·036 mm. from bend to bend. Very abundant.

Register Nos., Locality, &c.—XLVII. 3, 16, 19; LV. 5; all from Station 90; near Three Kings Islands, New Zealand, 100 fathoms.

Section *Tedanieæ.*

76. *Tedania crista-galli*, n. sp. (Pl. XII, fig. 8).

The single very fine specimen (Pl. XII, fig. 8) is a laterally compressed, massively lobose sponge, in which the main lobe gives off strong lateral spurs or buttresses; the whole sessile on a broad base. The upper part of the sponge forms a branching crest or ridge, bearing vents, some of which are open and of moderate size, while the majority appear to be closed and inconspicuous. The surface is strongly conulose and the conuli frequently form vertical ridges, between which is stretched a thin, subglabrous dermal membrane. Under a pocket lens the surface exhibits, between the conuli, a minutely reticulate appearance. The greatest length of the specimen is about 170 mm.; the maximum height about 100 mm.; the thickness of the principal lobe up to about 40 mm. The texture, in spirit, is very soft and compressible but fairly compact. The colour, both internally and externally, is chocolate-brown, which has deeply tinged the spirit in which the specimen is preserved.

The ectosome is about 0·35 mm. thick; not sharply marked off from the choanosome. It is fibrous and contains also granular pigment cells. In the meshes of the dermal reticulation it gives place to a thin, pore-bearing membrane, overlying extensive subdermal cavities from which comparatively narrow inhalant canals originate. The choanosome is collenchymatous, with a good deal of granular pigment. The collenchyma is very extensively developed between the flagellate chambers, which are spherical, about 0·04 mm. in diameter, and either eurypylous or with very short aphodal canaliculi.

The skeleton is not reticulate but consists mainly of very loose wisps of long, slender styli radiating from the interior of the sponge to the surface, where they terminate in the conuli. There are no well-defined skeletal fibres but here and there adjacent and parallel spicules are united together by spongin, which, though fairly abundant, is by no means conspicuous. At the surface occur a few sparsely scattered

brushes of small tornota or tornotoxea, especially associated with the ends of the spicule tracts of the main skeleton; otherwise there is no dermal skeleton at all.

Spicules:—(1) Very long, slender styli and tylostyli of the main skeleton, usually slightly curved or bent, rarely pointed at the base; size when full grown about 1·36 by 0·013 mm., but usually more slender and measured up to 1·7 mm. in length.

(2) Tornota or tornotoxea of the surface tufts; slender, usually slightly curved and hastately pointed at one or both ends, but rather narrower and more gradually pointed at the distal end; size about 0·32 by 0·004 mm.

(3) Rhaphides; nearly straight or slightly curved, gradually and finely pointed at each end; measuring about 0·4 by 0·003 mm.; not very abundant.

Numerous, very slender, hair-like spicules, much longer than (3), also occur, which are evidently young forms of the styli and tylostyli.

This is a very remarkable and well-characterised species, easily to be recognised by its external form, its colour, its skeleton arrangement and the great length and slenderness of the main skeletal spicules. In its skeletal characters it makes a near approach to the genus *Acanthella*.

Register No., Locality, &c.—XXXIV; Station 134, Spirits Bay, near North Cape, New Zealand, 11–20 fathoms.

Genus Tedaniopsis, n. gen.

The main skeleton is a reticulation of spicular fibre composed of stout diacts (strongyla, tylota) held together by spongin. There is also a dermal (or subdermal) skeleton of slender diacts (tornota, tylota, strongyla) in radially arranged brushes. Tylorhaphides may be present in addition to simple rhaphides.

It is quite possible that the turbinate form and the occurrence of two distinct growth stages, widely differing from one another, may also be generic characters. The type species is *Tedaniopsis turbinata*, n. sp., in which these two growth stages can be clearly demonstrated. The only other species known to me that can be quite safely referred to the same genus is Hentschel's *Oceanapia kirkpatricki* [1914] (*vide infra*). Kirkpatrick's *Oceanapia tantula* [1908] is probably a third. The description and figures of the very small specimens by which it is represented strongly suggest the first stage of a *Tedaniopsis*, and the spiculation agrees very well except for the absence of tylorhaphides. Whether or not the presence or absence of these remarkable spicules should be regarded as a ground for generic distinction it is hard to say. Probably not, for tylorhaphides occur in several Tedaniine genera. Topsent [1908] has described and figured them for *Tedania charcoti*; Hallmann [1914] makes them a characteristic feature of his genus *Hemitedania*, and I have myself [1921] described and figured them for *Tedanione wilsoni*.

It should be pointed out that the term "tylorhaphides" is here introduced for the first time for the curious pipette-like spicules in question.

The genus *Tedaniopsis* differs from *Tedanione* [Wilson 1894] in the presence of the main skeleton reticulation of stout strongyla or tylota, reminiscent of *Plocamia*. Wilson speaks of "stout skeletogenous oxeas" in *Tedanione fœtida*, but his figures show only very slender spicules and I suppose these are regarded as stout only in contrast with the rhaphides. His figure of the dermal membrane (Pl. XXIII, fig. 100), "strengthened by numerous oxeas of full size," is conclusive on this point. It is extremely doubtful whether Hallmann's *Hemitedania* [1914] is anything more than a synonym of *Tedanione*.

77. *Tedaniopsis turbinata*, n. sp. (Pl. XI, figs. 2–3; Pl. XIV, figs. 31–35).

The type specimen (R. N. XII, Pl. XI, figs. 2, 2 *a*), is a rather large, stipitate sponge of turbinate form, the upturned base of the cone being excavated to form a shallow cup with broadly rounded margin, while the down-turned apex is continuous with the stalk. The outer surface is marked by slight longitudinal ridges, radiating to the margin of the cup at wide intervals. The total height of the specimen is about 190 mm. and the maximum transverse diameter about 140 mm. The stalk is irregularly cylindrical, about 72 mm. in length and 18 mm. in diameter. The depth of the cup in the middle is about 25 mm. On the inner surface are scattered numerous small openings, with slightly prominent margins. These are evidently sphinctrate vents, whose size depends upon their state of contraction. The sphincter lies a little within the outer margin and may be open or closed. The diameter of these vents is usually about 1 mm. They are much more numerous on the inner surface of the cup than on the outside.* Both inner and outer surfaces are covered with a thin dermal membrane, firmly adherent to the underlying tissues. The upper part of the stalk, however, is expanded obliquely and there is a sharp line of junction between the expanded portion and the general body of the sponge (much sharper on the side opposite than on that represented in the drawing). Below this line the ordinary dermal membrane is replaced by a strongly developed cuticle, formed by a layer of (apparently) spongin spread over the dermal skeleton, the nature of which is quite different here from what it is above the line of demarcation. The texture of the body of the sponge is very soft open and friable, so that it has been a good deal damaged. The stalk, on the other hand, is hard and compact. The colour, in spirit, is pale greyish yellow.

In addition to this specimen there are in the collection three others, which differ widely from the type in certain respects, while agreeing pretty closely with one another. It appears to me fairly certain that these are merely young individuals in which the upper and larger part of the sponge has not yet been developed. They

* In drawing the figure of the external form it was necessary to make a considerable amount of restoration, and the artist has somewhat exaggerated the number of vents on the outer surface.

correspond to that portion of the type specimen which lies below what I have called the line of demarcation, and it is noteworthy that their outer surfaces have the same strongly cuticularised appearance.

Two of these small specimens (R. N. XIV. 1. *a* and *b*) have evidently been treated with osmic acid and thereby stained black superficially. They agree closely with one another. The larger of the two has the form of an elongated cone, about 51 mm. in height, tapering gradually from the deeply concave, up-turned, oblique base to the narrow attachment at the lower end, and with the long axis somewhat curved; horn-like. A remarkable feature of both is the presence of a sharply prominent rim separating the dermal membrane of the concave upper surface from that of the general surface. Indeed the two portions of the dermal membrane are actually discontinuous along this rim, with a narrow groove between them. I strongly suspect that this is a natural, pore-bearing groove, rendered necessary by the development of the layer of spongin over the outer surface. I have been unable to determine the presence of vents. Both specimens are remarkably cavernous, right down to the place where they have been broken off from their attachment, and the firm but thin rind or outer layer contrasts strikingly with the more or less pulpy interior, much as in *Phlœodictyon* and *Oceanapia*.

The third of these supposedly young specimens (R. N. XXVIII) differs from the other two in that the concave upper surface has become divided into three by an incipient process of branching (Pl. XI, fig. 3). From each of these three surfaces the dermal membrane has been completely, or almost completely, removed, exposing the cavernous interior. The colour is pale yellowish grey. This specimen measures about 41 mm. in height by 28 mm. in maximum transverse diameter.

My reasons for regarding these three small specimens as specifically identical with the type are as follows. (1) The spiculation is identical. (2) The external form agrees closely with that of the type *below the line of demarcation*, and there is the same cuticularization by a superficial layer of spongin. (3) All the specimens came from the same locality. If this view is correct it would appear that the sponge has two post-larval stages of growth sharply marked off from one another and differing in important particulars. The second stage is superposed upon the first one and forms the great bulk of the fully grown sponge. The part of the body formed in the first stage becomes partly solidified by excessive development of the skeleton to form the hard, compact stalk of the adult.

In spite of the attempts made to fix two of the small specimens with osmic acid, the condition of the material is not such as to permit of any very satisfactory account of the canal-system and histology.

In the fully grown sponge there is no pore-groove round the margin of the upper surface and the inhalant pores are presumably scattered through the thin dermal membrane which covers the surface generally. They can, however, be no longer recognised, being apparently all closed. Beneath the dermal membrane is a rather

thin, collenchymatous ectosome, for the most part by no means sharply distinguished from the choanosome, and penetrated here and there by very irregular subdermal cavities. The choanosome is very gelatinous, but at the same time coarsely granular in appearance, the deeply staining granules being apparently for the most part nuclei. The wider exhalant (and inhalant?) canals are interrupted at frequent intervals by thin, membranous diaphragms. The flagellate chambers are scattered irregularly in the gelatinous ground-substance, but large areas, where the ground-substance is less granular, appear to be quite free from them. They are approximately spherical, only about 0·02 mm. in diameter, and evidently eurypylous, though the actual openings are hardly to be distinguished in my sections.

The main skeleton is a very irregular, open network of spicular fibre, the fibres being composed of loose bundles of stout, curved tylota held together by a small amount of spongin. This network permeates the body of the sponge and undergoes great condensation, especially in the form of close-set, stout, longitudinal spicule tracts, in the stalk. Loose, radially arranged brushes of straight, slender diacts occur on the surface and may be regarded as constituting a dermal skeleton. Their ends commonly project slightly beyond the dermal membrane. A concentration of this skeleton around the vents constitutes a special oscular skeleton, forming a fringe round the margin of the vent and continued inwards for some distance in the wall of the exhalant canal. The interior of the body (and of the stalk) also contains great numbers of the very characteristic, slender, pipette-like rhaphides, mostly arranged in loose bundles. These spicules also occur lying horizontally in the dermal membrane. The smaller rhaphides, without the bulbous swelling, occur scattered throughout.

In the young specimens referred to above (except on the upper surface), and in that part of the full-grown sponge that lies below the line of demarcation, the dermal brushes of slender diacts are not present, their place being taken by a dense, irregular reticulation of the stout tylota, covered by the cuticular layer of spongin.

Spicules:—(1) Tylota (Pl. XIV, fig. 31); stout, more or less curved; with well-developed, oval heads; size about 0·5 by 0·025 mm. These spicules form the main skeleton reticulation.

(2) Slender diacts (fig. 32); straight or nearly so; variously ended, often slightly tylote or subhastate (tornote) and with a very few feebly developed terminal spines. Size about 0·34 by 0·006 mm. These spicules form the dermal brushes.

(3) Tylorhaphides (pipette-spicules) (figs. 34 and 35); long and slender, slightly curved or very nearly straight; slightly roughened all over; with a distinct, bulbous dilatation near one end, which is symmetrically but rather abruptly pointed, while the other end is very gradually and finely pointed. Size about 0·6 by 0·004 mm., with the bulb 0·008 mm. in diameter and 0·04 mm. from the nearest extremity of the spicule. These spicules occur singly and in bundles.

(4) Smaller rhaphides (fig. 33); nearly straight; without bulb; slightly roughened all over; tapering more gradually at one end than at the other;

sharply pointed at each end; about 0·18 by 0·002 mm. Scattered singly (and in bundles ?).

The above account of the spiculation is taken from the type specimen (R. N. XII) but the young specimens exhibit no difference in this respect.

There can be no doubt that this species is closely related to Hentschel's *Oceanapia* (*Tedaniopsis*) *kirkpatricki* [1914] from the Antarctic. The two species may, however, be readily distinguished by the fact that the stout amphistrongyla of *T. kirkpatricki* are replaced in the New Zealand species by tylota. Hentschel only had very small specimens, more or less similar in form to the young specimens of *T. turbinata*; probably they represented merely the first stage of growth.

Register Nos., Locality, &c.—R. N. XII; XIV. 1. *a* and *b*; XXVIII; LV. 1. *c*, 9 (fragments); all from Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

Section *Cœlosphæreæ.*

Genus Pyloderma, Kirkpatrick [1908.]

Sponge with parchment-like, easily separable dermal membrane. Oscula on conical projections on the upper part, inhalant pores in more or less raised pore-areas over the general surface. Megascleres slender oxea, arranged tangentially so as to form a feltwork in the dermal membrane and scattered or collected into fibres in the interior. Microscleres sometimes present in the form of tridentate isochelæ, sometimes absent.

This genus was founded by Kirkpatrick [1908] for the reception of Ridley and Dendy's *Halichondria latrunculioides* [1887]. Hentschel [1914] included this species in Inflatella and abandoned the genus Pyloderma. The discovery of a remarkable new species by the "Terra Nova" Expedition, closely resembling *Pyloderma latrunculioides* in all features except the presence of isochelæ, seems to justify the retention of Kirkpatrick's genus and at the same time throws a flood of light upon its true relationship. It does not, as Ridley and Dendy, followed by Kirkpatrick, supposed, belong to the Renierinæ, but to the Cœlosphæreæ, the mistake having arisen owing to the accident that the first species discovered happened to be lipochelous.

78. *Pyloderma demonstrans*, n. sp. (Pl. IX, fig. 4; Pl. XV, figs. 22–23*b*).

There are two specimens in the collection, which may be regarded as co-types. Both are much shrunken and corrugated as a result of the action of the spirit in which they are preserved, one is, in addition, a good deal damaged. The more perfect specimen (R. N. IX. *a*, Pl. IX, fig. 4) is obconical in form and has been torn off below from a narrow attachment. In life the broad upper surface was probably more or less flattened, but it is now greatly puckered, as are also the sides. The illustration gives but a poor idea of what must have been the natural appearance

of the sponge. The entire surface is covered, at fairly regular intervals, with prominent papillæ (or short fistulæ), those on the upper surface being clearly differentiated from those on the sides. The former are about 3 mm. in height by 1 mm. in diameter and each carries a small vent at the summit; the latter are only about 2 mm. in height and 1 mm. in diameter and have flattened tops which are obviously pore-areas. The height of the specimen is about 36 mm., the diameter across the top about 22 mm., the intervals between the papillæ about 4 mm. The colour in spirit is pale greyish yellow.

The choanosome is coarsely fibrous and evidently does not part readily from the thin, parchment-like ectosome, so that in contracting it has drawn the latter with it and thrown it into puckers.

The skeleton of the choanosome consists partly of very coarse, very irregularly arranged, spicular fibres, not very well defined, and partly of scattered megascleres and microscleres. That of the ectosome is a dense feltwork of tangentially placed oxea, not more than two or three spicules thick, exactly like that figured by Ridley and Dendy [1887] for "*Halichondria*" *latrunculioides*. The pore-areas are rendered very slightly hispid by the projection of the ends of longitudinally placed bundles of oxea; the projecting ends of longitudinally disposed oxea may also form a very slight fringe around the vents, but this is only sometimes visible.

Spicules:—(1) Oxea (Pl. XV, fig. 22); long, slender, nearly straight, gradually and sharply pointed at each end; size about 0·5 by 0·012 mm.

(2) Tridentate isochelæ (chelæ arcuatæ) (figs. 23*a*, 23*b*); robust, with stout, strongly curved, laterally compressed shaft and short teeth; length about 0·028 mm.; scattered very abundantly through the choanosome, especially in the walls of the canals, also sometimes on the surface of the sponge, outside the ectosomal skeleton.

Register Nos., Locality, &c.—IX. *a* and *b*; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

79. *Amphiastrella kirkpatricki*, n. sp. (Pl. IX, fig. 2; Pl. XV, figs. 28–31).

This very remarkable species is represented by one perfect specimen (Pl. IX, fig. 2), and the upper half of another. The perfect sponge (R. N. LIV. *a*) consists of a bladder-like body, vertically elongated to an oval form, attached to a stone by a flat, slightly constricted base, without root-like processes. From the central body are given off a number of elongated fistulæ. The largest of these, occupying the apex of the sponge, is elongatedly conical (now compressed by shrinkage) and terminates in a small vent at the narrow apex, without enlargement. Five others are similar in general form but shorter, and terminate each in a small, hemispherical, knob-like pore-area. A few others are still shorter and appear as if in different stages of growth. Owing to its thin, bladder-like character, the wall of the sponge has to some extent collapsed inwards. The height of the body is 32 mm., the

transverse diameter 24 mm. The length of the oscular fistula is 25 mm., of the fully developed poral fistulæ about 12 mm. The colour (in spirit) is now black, but this is evidently due to the action of osmic acid.

The imperfect specimen (R. N. LIV. *c*) resembles the type very closely, with a single, large, terminal, oscular tube and a number of poral fistulæ of exactly the same character as described above.

The ectosome of both body and fistulæ is thin and parchment-like, only about 0·25 mm. in thickness. The choanosome has shrunk away from it and now forms an amorphous mass of pulp, not nearly filling the interior of the sponge. This interior is traversed by a few stout, compact spicular fibres, about 0·34 mm. in diameter, forming a very coarse network with enormously wide meshes, the ends of some of the fibres being attached to the inner surface of the ectosome. In addition to these fibres the choanosome contains numerous scattered megascleres. The skeleton of the ectosome is a dense feltwork of tangentially arranged megascleres, in several layers.

Spicules:—(1) Tylota (Pl. XV, fig. 28), with slightly developed oval heads, ranging to strongylote (fig. 29); rather crooked; measuring about 0·8 by 0·02 mm.

(2) Birotulate isochelæ (amphidiscs) (figs. 30 and 31); with up to about ten slender, sharp-pointed, sharply recurved teeth at each end. These spicules are about 0·032 mm. in length. They are scattered in great abundance throughout the choanosome.

The only species of the genus *Amphiastrella* hitherto described is *A. birotulifera* from near Port Phillip Heads, Victoria [*vide* Dendy 1896], which has a closely similar spiculation but differs much in external features. The New Zealand species described above is, except for the presence of the microscleres, a typical *Inflatella* and closely resembles my *Inflatella spherica* from the same locality, and perhaps still more closely *Inflatella* (*Joyeuxia*) *belli* Kirkpatrick [1908] from the Antarctic, suggesting the possible derivation of the genus *Inflatella* from *Amphiastrella* by loss of amphidiscs, just as *Pyloderma latrunculioides* may have been derived from some such form as *P. demonstrans* by loss of tridentate isochelæ. It may be necessary at some future time to include the genus *Amphiastrella* in *Inflatella*, which has priority, but I think such a step would be premature at present.

Register Nos., Locality, &c.—LIV. *a* and *c*; Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

Genus Inflatella, Schmidt [1875].

Sponge bladder-like, with parchment-like dermal membrane and pulpy choanosome. Oscula and pores on elongated projections. Dermal skeleton of tangentially disposed megascleres. Internal skeleton feebly developed. Megascleres strongylote to oxeote. Microscleres absent.

For further information as to this genus I would refer more particularly to Lundbeck [1910] and Hentschel [1914].

80. *Inflatella spherica*, n. sp. (Pl. IX, fig. 3).

The single specimen (Pl. IX, fig. 3) is almost perfectly spherical, attached to a stone by a very short, broad peduncle, extending into flattened, root-like processes. From these processes come off a number of slender, almost filiform branches, which project freely in various directions, but are not very conspicuous. From the spherical body come off, at fairly regular intervals, fifteen rather slender and rather short fistulæ, most of which appear to be poral and the remainder oscular. It is not easy to distinguish between the two in their present state of contraction, but the oscular fistulæ are typically longer, tapering towards the extremity, where the small vent is placed, while the poral fistulæ are shorter, often slightly enlarged at the end, where there is a cup-shaped depression which I take to be the pore-area. The thin, parchment-like rind has partially collapsed into the hollow interior, while the choanosome has contracted into a pulpy mass. The colour (in spirit) is now black (brown internally), but this is evidently due to the action of osmic acid. The diameter of the body of the sponge is about 21 mm. The longest oscular fistula is about 9 mm. in length, a typical poral fistula about 4 mm.

The rind or ectosome is only about 0·25 mm. thick. Its skeleton consists of a close interlacement or feltwork of long slender oxea, in two or three layers. The skeleton of the choanosome is feebly developed and consists of similar oxea, mostly in loose wisps.

Spicules:—Oxea only; long, slender, slightly curved, gradually and sharply pointed at each end, *Halichondria*-like; measuring about 0·85 by 0·02 mm.

Except for its *Halichondria*-like spicules, in the possession of which it agrees with *Pyloderma*, this species is a very typical Inflatella, perhaps most nearly related to Hentschel's *Inflatella fistulosa* [1914] from the Antarctic, in which the megascleres are tornote. It also bears a considerable external resemblance to *Amphiastrella kirkpatricki*, found with it and described above.

Register No., Locality, &c.—LIV. *b*, Station 90, near Three Kings Islands, New Zealand, 100 fathoms.

81. *Histodermella australis*, n. sp. (Pl. XV, figs. 24–27).

The single specimen consists of an agglomeration of two (or three?) very irregular, vesicular individuals overgrown by other sponges, &c. (including *Ancorina progressa*, var. *diplococcus*) and closely resembling *Histodermella ingolfi* as described and figured by Lundbeck [1910]. The wall of the sponge is thin but tough and leathery, a good deal folded, and in both individuals a considerable portion of it has been torn away, exposing the spacious internal cavity, now empty, except for a small quantity of choanosomal tissue attached here and there to the wall. From

the central body come off numerous hollow tubes or fistulæ, varying much in dimensions, up to about 13 mm. in length by 4 mm. in diameter; often much more slender and occasionally branched. Most of these fistulæ are more or less widely open at the free end; their cavities are separated by diaphragms from the cavity of the body of the sponge. The body of the larger individual is about 25 mm. in diameter. The colour in spirit is pale grey.

The skeleton of the choanosome consists merely of scattered megascleres with a very few microscleres. That of the wall or rind (ectosome), of both body and fistulæ, is a dense feltwork of tylota, several or many layers thick, with a comparatively few acanthoxea.

Spicules:—(1) Tylota, with well-developed oval heads (Pl. XV, fig. 24), ranging to strongyla with no heads (fig. 25); slightly curved or crooked; varying much in size, up to about 0·7 by 0·02 mm. Those in the interior of the sponge are, on an average, much more slender than those in the rind, and are probably mostly young forms.

(2) Acanthoxea (fig. 26); short, stout, straight or nearly so; thickly covered with short, sharp spines, except at the apices, which are quite smooth and sharply pointed; size about 0·17 by 0·034 mm. (including spines). Occasionally a stylote form is met with (fig. 27).

The acanthoxea occur pretty abundantly just within the thick ectosomal layer of tylota. They are especially abundant, almost to the exclusion of other spicules, in the membranous diaphragm that separates the cavity of the fistula from that of the body of the sponge.

(3) Sigmata; usually slender, C- or S-shaped, measuring up to about 0·068 mm. from bend to bend. Not very numerous or conspicuous, scattered in the choanosome.

I have also seen two small isochelæ in the choanosome, the form of which was difficult to make out. These may perhaps be regarded as vestigial but it is not certain that they belong to the sponge, with which several other species, including an encrusting *Hymedesmia*, are closely associated.

Except for the absence of the isochelæ (chelæ arcuatæ) I do not see how this species can be distinguished from *Histoderma ingolfi*, described by Lundbeck [1910] from deep water off the S.W. of Iceland and since recorded by Stephens [1921] from the North Atlantic. It is extremely interesting to find a New Zealand representative of this very curious genus.

Register No., Locality, &c.—L. 1. *d*; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

Sub-family AXINELLINÆ.

Section HETEROXYEÆ.

Genus Parahigginsia, n. gen.

Sponge composed of thin lamellæ which may anastomose with one another. Canal-system like that of *Phakellia*, with inhalant and exhalant surfaces. Main

skeleton an irregular reticulation of stout oxea. No special dermal skeleton. Spicules of two kinds ; short, stout oxea and slender acanthoxea (microxea).

This genus is distinguished from *Higginsia* by its *Phakellia*-like habit and canal-system, and by the absence of long, slender megascleres.

82. *Parahigginsia phakellioides*, n. sp. (Pl. XI, fig. 4 ; Pl. XV, figs. 32 and 33.)

There are two pieces of this sponge in the same jar and from the same locality ; it is possible that they are parts of the same specimen. The sponge (Pl. XI, fig. 4) consists of a system of thin, curved lamellæ, branching off from and anastomosing with one another in a very irregular fashion. The larger of the two pieces measures about 140 mm. in height by 80 mm. in breadth ; the lamellæ have a fairly uniform thickness of about 2·5 mm. Both surfaces are smooth, and even subglabrous, in spirit. They may be distinguished, with some degree of probability, as being respectively inhalant and exhalant. The former is thickly studded with very small pore-sieves, the latter with minute vents ; both pore-sieves and vents are only about 0·25 mm. in diameter. The texture is inflexible, rather hard and brittle ; the colour in spirit pale yellowish grey.

The canal-system is extraordinarily like that of *Phakellia* [cf. Dendy, 1921, p. 118]. The lamella is perforated by numerous canals about 0·25 mm. in diameter, extending from the inhalant surface, where they are covered over by the very thin, pore-bearing, dermal membrane, to the exhalant surface, where they open each by one of the small vents. These canals do not always run straight through but may ramify to a considerable extent. They might be interpreted in most sections as inhalant and exhalant canals interdigitating, but I think that, as in *Phakellia*, they really run through from surface to surface. The smaller canals are lacunar. The flagellate chambers are about 0·04 mm. in diameter, subspherical and eurypylous. The ectosome appears to be represented only by the thin dermal membrane. The mesoglœa of the choanosome is collenchymatous and sparingly developed.

The main skeleton is a fairly dense reticulation of stout oxea, bundled together for the most part in stout irregular tracts, but with no distinct fibres and apparently no spongin. This reticulation may be specially concentrated beneath the surface, but one cannot say that there is a distinct dermal skeleton.

Spicules:—(1) Oxea (Pl. XV, fig. 32) ; short, stout, slightly curved, sharply and somewhat abruptly pointed at each end ; of very uniform size, about 0·34 by 0·022 mm.

(2) Acanthomicroxea (fig. 33) ; very slender, more or less curved or bent, sharply pointed at each end, minutely spined. Size about 0·088 by 0·002 mm. Scattered abundantly through the choanosome and in the dermal membrane.

The interior of this sponge is penetrated by a commensal hydroid.

Register No., Locality, &c.—XVII ; Station 96, 7 miles E. of North Cape, New Zealand, 70 fathoms.

Family CLAVULIDÆ.

Sub-family SPIRASTRELLINÆ.

Genus Discorhabdella, n. gen.

Encrusting Spirastrellinæ with radially arranged skeleton. The principal megascleres are large styli or tylostyli, which may be spiny, associated with brushes of smooth tylostyles, and with abbreviated, pseudastrose acanthotylostyles echinating the substratum. Microscleres are present in the form of isochelæ and oxydiscorhabds.

This is a very remarkable genus in more ways than one. The pseudastrose acanthotylostyle (Pl. XV, figs. 35 and 35 *a*) is an extremely interesting spicule, and the interest attaching to it is increased by the fact that a closely similar spicule has been described by Hinde and Holmes [1892, Pl. XII, figs. 1 and 2] from the lower tertiary strata of Oamaru, in the South Island of New Zealand. These authors, however, altogether failed to interpret the true nature of the spicule and assigned it to the genus *Latrunculia*. The same authors (*op. cit.* Pl. VIII, fig. 29) also figure the curiously tuberculated base of a large megasclere which closely resembles the large acanthosubtylostyle of *Discorhabdella*. There is thus good reason to believe that the genus *Discorhabdella* was living in New Zealand waters in early Tertiary times, in association, probably, with many other surviving genera of sponges. The nearest approach to the pseudastrose spicule which I know of amongst existing species is found in Bowerbank's [1866,1874] *Hymeraphia stellifera*, a not very distantly related, encrusting sponge, for which Gray [1867] proposed the genus *Mesapos*.

A still more remarkable spicule is the oxydiscorhabd, rather like that of the genus *Barbozia* [Dendy, 1921], where it is also associated with chelæ, but of a quite different form from those of *Discorhabdella*. Here again, then, we have clear evidence of the origin of the Spirastrellinæ from Ectyonine ancestors, for in most respects *Discorhabdella* is a typical member of the latter group, evidently closely related to such encrusting genera as *Hymedesmia* and *Hymeraphia*. It may also be related to the Ectyonine genus *Fusifer* [Dendy, 1896] in which the microscleres are toxa and smooth microxea. I am strongly inclined to think that the latter are the precursors of the discorhabd series of spicules, and that they themselves may be homologous with the microxea (rhaphides) of such species as *Mycale magellanica* and *M. lilliei*, which, in turn, are clearly derived from the rhaphides of ordinary trichodragmata.

83. *Discorhabdella incrustans*, n. sp. (Pl. XV, figs. 34–38.)

The sponge (in spirit) forms a greyish white crust, up to about 1 mm. in thickness and 15 mm. in diameter, on a small angular pebble. The surface, under a lens, appears rather strongly hispid, but no vents or pores could be made out.

The megascleres are all radially arranged with regard to the substratum. The

large acanthosubtylostyles have their bases planted on the substratum while their apices project far beyond the surface of the sponge, causing the conspicuous hispidation thereof. They stand at some distance apart from one another and their inner portions are surrounded by radiate brushes of slender tylostyles, whose apices project beyond the surface but not nearly so far as those of the very much larger acanthosubtylostyles. Between the bases of the latter the substratum is echinated by the very curious pseudastrose acanthotylostyles. The chelæ occur abundantly and chiefly in the dermal membrane, and the oxydiscorhabds throughout the soft tissues.

Spicules:—(1) Large acanthosubtylostyles (Pl. XV, figs. 34–34 *c*); slightly curved towards the base; tapering very gradually from base to sharply-pointed apex; base tuberculate rather than spined, the remainder of the spicule quite smooth; size up to about 1·7 by 0·05 mm.

(2) Abbreviated, pseudastrose acanthotylostyles (figs. 35 and 35 *a*); with large, subspherical base covered with short conical spines; very short, smooth shaft, and enlarged, subspherical apex (but much smaller than the base), covered with small conical spines which may be recurved towards the base. Length about 0·052 mm., diameter of base (including spines) about 0·04 mm.

(3) Smooth, slender tylostyles (fig. 36); slightly curved, with distinct oval head; tapering gradually to sharply-pointed apex and also towards the head, forming a neck; quite smooth; size about 0·54 by 0·012 mm.

(4) Isochelæ (isancoræ) (figs. 37 and 37 *a*); with slightly curved, non-fimbriated shaft and usually four (occasionally three or five) rather long, narrow, sharply-pointed and sharply-recurved teeth at each end. Length about 0·048 mm.

(5) Oxydiscorhabds (fig. 38); with straight, slender shaft, sharply pointed at each end, and a swollen, spiny node placed symmetrically towards each extremity. Between the nodes the shaft also often appears to be slightly spiny. Length about 0·028 mm., diameter of shaft about 0·0013 mm.

As already mentioned, there is reason to believe that the genus *Discorhabdella* is represented in the lower Tertiary deposits of Oamaru. The pseudastrose acanthotylostyle figured by Hinde and Holmes [1892], however, differs in one interesting particular from that of the recent species described above, viz. in the possession of a specially large terminal spine which clearly represents the original apex of the spicule. The disappearance of this apex in the spicule of *Discorhabdella incrustans* seems to represent a further stage in evolution that has been reached since the period of the Oamaru deposits.

Register No., Locality, &c.—XLVI. 3; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

84. *Trachycladus stylifer*, n. sp. (Pl. XII, fig. 7; Pl. XV, figs. 39–42.)

The single specimen (Pl. XII, fig. 7) is stipitate and very irregularly branched.

Stalk and branches cylindrical, about 5 mm. in diameter. Branches rather short and usually tapering to pointed extremities; rarely anastomosing. Surface of branches very minutely conulose, vents not recognizable. Texture tough, flexible, elastic. Colour now (in spirit) black, evidently stained with osmic acid. When spread out the specimen has a maximum height of about 130 mm. and a maximum breadth of about the same. The stalk is about 24 mm. long but has been broken off below.

The skeleton arrangement is quite typical. A condensed axis of long styli, nearly all arranged lengthwise, occupies rather less than one-third of the diameter of the branch, and gives off obliquely ascending, rather loose columns of styli which curve outwards to the surface. There is very little spongin. The spinispiræ are scattered in enormous abundance throughout the interior of the sponge and also form a dense dermal crust.

Spicules:—(1) Styli (Pl. XV, fig. 40); rather slender and usually slightly curved; narrowing slightly to the evenly rounded base and tapering gradually to the rather abruptly pointed apex, which may be blunted (fig. 39). Very uniform in size and shape. Measuring about 0·5 by 0·017 mm.

(2) Spinispiræ (fig. 41); of the usual *Trachycladus* type; with about $1\frac{1}{2}$ complete turns; minutely spined; length in a straight line from end to end about 0·012 mm.; occasionally becoming more or less uncurled.

(3) Microrhabds (fig. 42); typically stout and irregularly oval in outline, sometimes bent, surface more or less uneven, but smooth; size when full grown about 0·02 by 0·008 mm., but numerous more slender forms occur. These spicules are very abundant in the interior of the sponge, but not nearly so numerous as the spinispiræ.

The discovery of this species marks an interesting extension of the geographical range of the genus *Trachycladus*, which has hitherto been found only along the Australian coast, where it is common and widely distributed. The Australian specimens show a good deal of variation in spiculation and Hallmann [1916] has attempted to distinguish between a number of species accordingly. It may be regarded as very doubtful, however, whether they should not all be included in Carter's *Trachycladus lævispirulifer* [1879, 1885–6], the type-species of the genus. In all the Australian specimens hitherto recorded the megascleres are oxeote or strongylote, and styli only occur rarely and exceptionally. In *T. stylifer*, on the other hand, they are practically all stylote and I have not seen a single oxeote, though an occasional but very rare strongylote may be met with. This difference seems to be a sufficient ground for the separation of the New Zealand and Australian species.

As in the Australian specimens the soft tissues of the New Zealand sponge are crowded with short, jointed, algal rods.

Register No., Locality, &c.—LV. 4; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

Genus Dotonella, n. gen.

Sponge thinly encrusting; with a deep layer of large and a superficial layer of small spinispiræ; surface hispidated with large tylostyli based upon the substratum.

This very interesting genus is founded upon a species which is evidently closely related to Carter's *Dotona pulchella*, originally described [1880, p. 57] from the Gulf of Manaar and re-described by Topsent [1904] from the Azores. *Dotona*, however, is a boring sponge, and in it the smaller spinispira is represented by a short, rod-like spicule with a bunch of spines at each end and a single whorl of spines in the middle; while the large tylostyles are represented by small, slender styli, chiefly congregated in the small papillæ which occupy the terminal openings of the excavations. The small spinispiræ of *Dotonella* are closely similar to those of *Trachycladus*. The large spinispiræ are much larger and more coarsely spined than the corresponding spicules of *Dotona pulchella*.

Another encrusting sponge in which a relatively large spinispira resembling that of *Dotonella* occurs is Carter's *Rhaphidhistia spectabilis* [1879], but in this case it is associated with an oxeote megasclere. Topsent's *Spiroxya heteroclita* [1900] appears to me to be a second species of *Rhaphidhistia*. It agrees with *Dotonella mirabilis* in having two kinds of spinispiræ, but they are quite different from those of the New Zealand sponge.

Hinde and Holmes [1892, Pl. VII, fig. 38] have figured a fossil spicule from the lower Tertiary deposits of Oamaru, in the South Island of New Zealand, which closely resembles the large spinispira of *Dotonella mirabilis* and is even larger.

85. *Dotonella mirabilis*, n. sp. (Pl. XV, figs. 43–45.)

This remarkable sponge is represented by two very thin, white crusts attached to the block of black basalt so often referred to in this Report. The larger of the two (R. N. XXXV. *d*) is about 22 mm. in diameter. The surface is generally smooth but with minute, irregularly placed punctations scattered over it, not very thickly. These punctations mark the points of insertion of long tylostyles, which project from the surface in life but which are now all broken off except in certain small concave areas where they have been protected from abrasion and where they give the surface a coarsely hispid character.

The skeleton consists of three distinct parts: (1) next to the substratum, a dense layer of the large spinispiræ; (2) above the latter, at the surface of the sponge, a dense layer of the small spinispiræ; (3) the large hispidating tylostyles, with bases resting on the substratum and shaft penetrating the two layers of spinispiræ to project far beyond the surface.

Spicules:—(1) Tylostyles (Pl. XV, fig. 43); small, slightly curved; tapering gradually from the well-developed spherical head to near the sharply-pointed apex, where the taper becomes more abrupt; length up to about 1 mm., with head 0·024 mm. in diameter and shaft 0·016 mm. in diameter where it joins the head.

(2) Large spinispiræ (fig. 44); consisting of a stout, slightly curved shaft, spined at the two blunt ends and with similar short spines arranged typically on a spiral ridge extending from end to end; size about 0·12 by 0·016 mm. (including spines).

(3) Small spinispiræ (fig. 45); consisting of a stout rod, twisted into a spiral of about $1\frac{1}{2}$ turns and minutely spined on the concave side; length of spicule as a whole about 0·012 mm., thickness of shaft about 0·004 mm.

Register Nos., Locality, &c.—R. N. XXXV. *d, n*; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

Sub-Family SUBERITINÆ.

86. *Suberites carnosus* (Johnston), var. *novæ-zealandiæ*, nov.

(For literature and synonymy *vide* Topsent [1900].)

This widely distributed species is represented by a single small specimen, ovoid in form, about 20 by 10 mm., slightly narrower at one end than at the other. There are no conspicuous vents, but the surface is pitted with numerous small, oval cavities, each of which is typically inhabited by a small amphipod crustacean. Some of the cavities are empty, and some of the empty cavities appear to have healed up and become filled with sponge-tissue. The texture is very compact, but characteristically soft, fleshy and compressible. The colour in spirit is pale yellow.

The arrangement of the skeleton is quite typical, a confused mass of interwoven spicules in the interior passing into a surface-layer of radiate brushes of shorter tylostyles imbedded in the fibrous cortex.

Spicules:—Slender tylostyles; with well-developed heads, which may be very irregular and may be (apparently) shifted to a greater or lesser extent, sometimes very great, towards the middle of the spicule. The proportion of such abnormal spicules is rather large, and their occurrence suggests a possible mode of origin for the remarkable and anomalous centrotylote spicules of *Ficulina ficus*. Sometimes there is a terminal head and an additional, irregular swelling some distance along the shaft. These spicules vary so much in size that it seems almost useless to give individual measurements; perhaps from about 0·136 by 0·003 mm. in the surface-brushes to about 0·42 by 0·005 mm. in the interior gives the range of variation with sufficient accuracy. A direct comparison with a preparation in Mr. Carter's cabinet, purporting to come from Johnstone's type-specimen in the British Museum, gives the impression that the spicules are decidedly smaller and more slender than in the British form, but the difference is by no means great enough to justify specific distinction, and my measurements agree closely enough with those given by Topsent [1900]. More remarkable is the not infrequent occurrence of long, slender oxea, with a centrally or excentrically placed swelling. These are obviously derivatives of the slender tylostyles, and until more is known about their constancy in different specimens they may be regarded as abnormalities. They are very interesting, however, and seem to

throw a new light upon the significance of the long, slender, centrotylote oxea in *Halicnemia patera* [cf. Dendy, 1921].

According to Topsent the ectosome of *Suberites carnosus* is collenchymatous. In the New Zealand specimen it is distinctly fibrous, but this is probably a very variable character, and I can hardly believe that there is no fibrous tissue in the European form.

Register No., Locality, &c.—XLIV; Station 91, S. of Three Kings Islands, New Zealand, 300 fathoms.

87. *Polymastia conigera*, Bowerbank [1874].

There is one small specimen in the collection which agrees very closely with the specimens obtained by the "Sealark" Expedition in the Indian Ocean [Dendy, 1921]. It is more nearly spherical than hemispherical in shape, and has been attached by a broad base. It bears two low, rounded, mammiform projections, of solid appearance and without visible perforations. The diameter of the sponge is about 9 mm. The colour in spirit is pale yellowish grey, darker and more yellow internally; the texture firm and compact throughout.

The cortex is about 0·43 mm. thick, and divided into three zones; externally the very dense surface pile of small, radially arranged tylostyles; internally a densely felted layer of larger tylostyles, lying more or less tangentially. These two layers are of about equal thickness, and between them lies a clearer zone showing a strongly fibrous structure and containing numerous small, radially arranged tylostyles which appear to be passing through to take their place in the surface pile. This middle layer is not distinguishable in the Indian Ocean specimens.

The main skeleton consists of radial bundles of long tylostyles whose ends penetrate the cortex without projecting conspicuously on the surface, though many of the spicules have been broken off just outside the surface pile. Between these main radial bundles are scattered other bundles of tylostyles of various sizes, and lying in all sorts of directions, including small bundles of the surface forms, which evidently develop in the choanosome and pass outwards.

The spicules are so similar to those of the Indian Ocean specimens described by me that it is unnecessary to say more about them. The relationships of the species are discussed in the same place.

Previously known Distribution.—British Seas (Bowerbank); Saya de Malha, Indian Ocean (Dendy).

Register No., Locality, &c.—XXXVII; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

Genus Microtylostylifer, n. gen.

Sponge massive, with thin dermal membrane. Skeleton reticulate throughout. Megascleres, large styli with constricted bases; microscleres, microtylostyli, scattered throughout the sponge.

There seems no alternative but to propose a new genus for the curious sponge described below. The spiculation seems to approach most closely that of the genus *Polymastia*, if the microtylostyles may be supposed to represent the small tylostyles of that genus ; but the external form and skeleton arrangement are totally different, and the absence of cortex affords another means of distinction.

88. *Microtylostylifer anomalus*, n. sp. (Pl. XV, figs. 46–49.)

This species is represented in the collection by a small, massive fragment, measuring about 15 mm. in diameter. Its consistence is crumb-of-bread-like, but harsh, owing to the large megascleres ; the colour in spirit light yellowish grey. The surface, where uninjured, is covered with a thin, transparent, easily separable, dermal membrane, with inhalant pores scattered in the meshes of the reticulate dermal skeleton. Vents were not recognised.

The main skeleton is an irregular reticulation of large styli, single and in loose bundles, without any visible spongin. The dermal skeleton is a similar reticulation of bundles of megascleres and single spicules, but all lying tangentially, and with a greater proportion of the more slender megascleres.

Spicules :—(1) Styli (Pl. XV, fig. 46) ; stout, more or less curved or bent ; much constricted at the evenly rounded base, gradually and sharply pointed at the apex ; measuring about 0·76 by 0·027 mm. Numerous shorter and more slender forms (fig. 47) occur, which are presumably young stages.

(2) Microtylostyles (figs. 48 and 49) ; slender, slightly curved or bent ; rather feebly tylote at the base and bluntly pointed at the apex ; size very uniform, about 0·064 by 0·0016 mm. These spicules, which may be regarded as microscleres, occur in immense numbers, scattered through the dermal membrane, where they all lie tangentially, and through the interior of the sponge.

A few sigmata, of quite ordinary form, are also found in my preparations, but their relative scarcity and their distribution in the sponge lead me to believe that they are foreign ; nor are they the only foreign spicules present.

Register No., Locality, &c.—XLVII. 7 ; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms.

Order EUCERATOSA.

Family DARWINELLIDÆ.

89. *Megalopastas elegans* (Lendenfeld).

Dendrilla elegans, Lendenfeld [1889] ; *Megalopastas elegans*, Dendy [1905].

There is a single good specimen of this common Australian species in the collection, which closely resembles some of my material from the neighbourhood of Port Phillip Heads. It is erect, digito-lamellate, and may have been pedunculate, but has been cut off below. The surface is conulose and the ends of the

primary fibres, and even some of the secondaries, project considerably in most parts, owing, apparently, to shrinkage of the soft tissues between them. The thick, opaque-looking dermal membrane is glabrous, and in many places minutely reticulate. The vents vary much in size, and are scattered. The height of the specimen is 132 mm. and the breadth 103 mm. The colour in spirit is dark greenish grey (which appears to be very characteristic of the species), both internally and externally. The colouring matter is, however, soluble in alcohol, and my Victorian material shows that it disappears in course of time. The same material shows that specimens dried with the flesh on are black. The texture in spirit is soft and compressible, but resilient.

The skeleton is a wide-meshed network of stout, heavily "pithed," light or dark coloured horny fibre, of which the primary lines radiate outwards and end (normally) in the surface conuli. The secondaries are very irregular, some running straight across between the primaries and others forming lattice-works, especially in the angles where the primaries diverge from one another.

The external form of this species has been figured by Lendenfeld (loc. cit., Pl. XLIV, fig. 9), and the anatomy by myself (loc. cit., Pl. XV, fig. 4).

Previously known Distribution.—Australian Seas.

Register No., Locality, &c.—IV; Station 134, Spirits Bay, near North Cape, New Zealand, 11–20 fathoms.

Family SPONGELIIDÆ.

90. *Spongelia hirciniformis* (Carter).

Dysidea hirciniformis, Carter [1885–6]; *Spongelia fragilis*, var. *hirciniformis* Lendenfeld [1889].

This species is represented in the collection by two specimens, of which the smaller (R. N. XXIII. *b*) is the more perfect, consisting of a single, long, cylindrical process, rising from a small, irregular mass of the same sponge, which has apparently had no attachment. The basal mass is about 22 mm. in maximum diameter; the process commences with a diameter of 4 mm., gradually increasing to 8 mm. (excluding conuli) and finally tapering away to a sub-acuminate apex; its total length is 120 mm. The larger specimen (R. N. XXIII. *a*) is closely similar in appearance but has been cut off below, so that there is no narrow proximal portion; its total length is now 330 mm. and its maximum diameter (exclusive of conuli) is about 10 mm. Neither specimen shows any sign of branching. The conuli are acute and about 2 mm. in height. The vents are rather small and inconspicuous, scattered between the conuli. The dermal membrane is distinct and glabrous and has a slightly ridged appearance as it is raised up on the conuli. The colour in spirit (after formalin) is pale yellowish grey, the texture, as a whole, is tough, flexible and resilient.

The skeleton consists of an irregular, wide-meshed, axial network from which fibres branch off into the conuli. The axial portion consists of stout, strongly

laminated, dark amber-coloured, horny fibre ; the main longitudinal fibres abundantly cored with sand and broken spicules, the connecting fibres much less abundantly cored or quite clear. The peripheral branches subdivide slightly and terminate in the conuli, where they consist almost entirely of broken spicules, the proportion of spongin increasing centripetally ; they are only very sparsely united by connecting fibres.

The main longitudinal fibres of the skeleton vary up to 0·34 mm. in diameter.

The flagellate chambers are sac-shaped and eurypylous, and measure up to about 0·12 mm. in longer diameter.

This appears to be merely a robust variety of Carter's Australian species. I have examined a section of the latter from British Museum material and find the axial portion of the skeleton a good deal less strongly developed but the peripheral fibres more abundantly joined by connecting fibres.

Previously known Distribution.—South coast of Australia (Carter).

Register No., Locality, &c.—XXIII. *a*, *b* ; August 2nd, 1911, 30–14 fathoms, off North Cape, New Zealand, sandy bottom.

91. *Spongelia spiculivora*, n. sp.

The best specimen (R. N. XXX. 2) is an irregularly massive, subdigitate sponge, about 54 mm. in length by 20 mm. in maximum diameter, probably repent in growth. The surface is coarsely subconulose, the conuli being low and far apart and sometimes connected by low ridges. There is a thin dermal membrane having a rather coarsely and unevenly reticulate appearance. Vents and pores are not distinguishable. The interior is cavernous. The texture (in spirit) is fairly firm and tough. The colour is white, with a curiously translucent appearance.

The skeleton is an irregular jumble of spicules, chiefly large oxea and triænes, derived from Stellettid sponges, and in such a perfect state of preservation that the sponge itself was at first mistaken for a Stellettid. There is hardly any other foreign matter and the spicules are held together only here and there by very locally and, on the whole, sparsely developed spongin. There is no dermal skeleton.

The distinction between ectosome and choanosome is not obvious. There is an abundantly developed mesoglœa in places, especially around the larger canals and cavities. It is collenchymatous, but rather richly fibrillated, and contains numerous small nuclei. The flagellate chambers are crowded together in some parts, more sparingly scattered in others. They are large, sac-shaped and eurypylous ; measuring up to about 0·1 mm. in greater diameter.

It is possible that this species may be identical with one or other of the Australian sand-sponges, but these are at present so imperfectly known as to make an identification very hazardous.

Register Nos., Locality, &c.—VII. 1 ; Station 90, near Three Kings Islands, N. of New Zealand, 100 fathoms ; XXX. 2 ; Station 144, from Cape Maria van Diemen, W. by S., 7 miles, 35–40 fathoms.

V.—LIST OF LITERATURE REFERRED TO.

Bowerbank, J. S.—1864. "A Monograph of the British Spongiadæ. Vol. I." London.

„ —1866. "A Monograph of the British Spongiadæ. Vol. II." London.

„ —1873 A. "Contributions to a General History of the Spongiadæ. Part IV." Proc. Zool. Soc. London, 1873, pp. 3–25.

„ —1873 B. "Contributions to a General History of the Spongiadæ. Part V." Proc. Zool. Soc. London, 1873, pp. 319–333.

„ —1874. "A Monograph of the British Spongiadæ. Vol. III." London.

Carter, H. J.—1872. "On two new Sponges from the Antarctic Sea . . . and on a new species of Tethya from Shetland," &c. Ann. Mag. Nat. Hist. (4) IX, pp. 82–84.

„ —1876. "Descriptions and figures of deep-sea Sponges and their Spicules from the Atlantic Ocean," &c. Ann. Mag. Nat. Hist. (4) XVIII, pp. 226–240, 307–324, 388–410, 458–479.

„ —1879. "Contributions to our Knowledge of the Spongida." Ann. Mag. Nat. Hist. (5) III, pp. 284–304, 343–360.

„ —1880. "Report on Specimens dredged up from the Gulf of Manaar," &c. Ann. Mag. Nat. Hist. (5) VI, pp. 35–61, 129–156.

„ —1881. "Supplementary Report on Specimens dredged up from the Gulf of Manaar," &c. Ann. Mag. Nat. Hist. (5) VII, pp. 361–385.

„ —1882. "Some sponges from the West Indies and Acapulco, in the Liverpool Free Museum," &c. Ann. Mag. Nat. Hist. (5) IX, pp. 266–301, 346–368.

„ —1885–6. "Descriptions of Sponges from the neighbourhood of Port Phillip Heads," &c. Ann. Mag. Nat. Hist. (5) XV–XVIII.

„ —1886. "Supplement to the Descriptions of Mr. J. Bracebridge Wilson's Australian Sponges." Ann. Mag. Nat. Hist. (5) XVIII, pp. 271–290, 369–379, 445–466.

Dendy, A.—1890. "Observations on the West Indian Chalinine Sponges, with Descriptions of new Species." Trans. Zool. Soc. London. Vol. XII, Pt. 10, pp. 349–368.

„ —1891. "Monograph of the Victorian Sponges: Part I. The Organisation and Classification of the Calcarea Homocœla with Descriptions of the Victorian Species." Trans. Roy. Soc. Victoria. Vol. III, pp. 1–82.

„ —1892. "Synopsis of the Australian Calcarea Heterocœla," &c. Proc. Roy. Soc. Victoria (New Series). Vol. V, pp. 69–116.

„ —1895. "Catalogue of Non-Calcareous Sponges collected by J. Bracebridge Wilson," &c. Part I. Proc. Roy. Soc. Victoria. Vol. VII, pp. 232–260.

„ —1896. "Catalogue of Non-Calcareous Sponges collected by J. Bracebridge Wilson," &c. Part II. Proc. Roy. Soc. Victoria. Vol. VIII, pp. 14–51.

„ —1898. "On the Sponges described in Dieffenbach's 'New Zealand.'" Trans. and Proc. New Zealand Institute. Vol. XXX, pp. 316–320.

„ —1905. "Report on the Sponges collected by Professor Herdman at Ceylon in 1902." Report Pearl Oyster Fisheries, Roy. Soc. London. Part III, pp. 57–246.

„ —1916 A. "Report on the Non-Calcareous Sponges collected by Mr. James Hornell at Okhamandal," &c. Report to the Government of Baroda on the Marine Zoology of Okhamandal in Kattiawar. Part II, pp. 93–146, London, Williams and Norgate.

„ —1916 B. "Report on the Homosclerophora and Astrotetraxonida collected by H.M.S. 'Sealark' in the Indian Ocean." Trans. Linn. Soc. Zool. Vol. XVII, pp. 225–271.

„ —1921. "Report on the Sigmatotetraxonida collected by H.M.S. 'Sealark' in the Indian Ocean." Trans. Linn. Soc. Zool. Vol. XVIII, pp. 1–164.

Dendy, A., and Row, R. W. H.—1913. "The Classification and Phylogeny of the Calcareous Sponges," &c. Proc. Zool. Soc. Lond. 1913, pp. 704–813.

Ehlers, E.—1870. "Die Esper'schen Spongien in der zoologischen Sammlung der k. Universität, Erlangen." Universitäts-Programm, Erlangen.

George, W. C., and Wilson, H. V.—1919. "Sponges of Beaufort (N.C.) Harbor and Vicinity." Bull. Bureau of Fisheries. Vol. XXXVI. Washington.

GRAY, J. E.—1867. "Notes on the Arrangement of Sponges, with the Descriptions of some new Genera." Proc. Zool. Soc. London, 1867, pp. 492–558.

HALLMANN, E. F.—1914. "A Revision of the Monaxonid Species described as new in Lendenfeld's Catalogue of the Sponges in the Australian Museum. Part III." Proc. Linn. Soc. N.S.W. Vol. XXXIX, pp. 398–446.

,, —1916. "A Revision of the Genera with Microscleres included, or provisionally included, in the Family *Axinellidæ*; with descriptions of some Australian Species." Part I. Proc. Linn. Soc. N.S.W. Vol. XLI, pp. 453–491.

,, —1917 A. *Id.* Part III. Proc. Linn. Soc. N.S.W. Vol. XLI, pp. 634–675.

,, —1917 B. "On the Genera Echinaxia and Rhabdosigma." Proc. Linn. Soc. N.S.W. Vol. XLII, pp. 391–405.

HANITSCH, R.—1889. "Second Report on the Porifera of the L.M.B.C. District." Proc. Liverpool Biol. Soc. Vol. III, pp. 155–173.

HENTSCHEL, E.—1909. "Tetraxonida. Th. 1." Die Fauna Südwest-Australiens. Bd. II, pp. 347–402. Jena, G. Fischer.

,, —1912. "Kiesel-und Hornschwämme der Aru- und Kei- Inseln." Abh. Senckenberg. Ges. Bd. XXXIV, pp. 291–448.

,, —1914. "Monaxone Kieselschwämme und Hornschwämme der deutschen Südpolar-Expedition 1901–3." Deutsch. Südpol.-Exped. Bd. XV. Zool. Bd. VII, pp. 35–141.

HINDE, G. J., and HOLMES, W. M.—1892. "On the Sponge-Remains in the Lower Tertiary Strata near Oamaru, Otago, New Zealand." Linn. Soc. Journal Zool. Vol. XXIV, pp. 177–262.

IJIMA, I.—1904. "Studies on Hexactinellida. Contribution IV (Rossellidæ)." Journ. Coll. Sci. Univ., Tokyo. Vol. XVIII, Art. 7.

KIESCHNICK, O.—1898. "Kieselschwämme von Amboina." Inaugural Dissertation. Jena.

KIRKPATRICK, R.—1908. "Tetraxonida." National Antarctic ("Discovery") Expedition, Natural History. Vol. IV, pp. 1–56.

LENDENFELD, R. von.—1887. "Die Chalineen des Australischen Gebietes." Zool. Jahrb. Vol. II, pp. 723–828.

,, —1889. "A Monograph of the Horny Sponges." Trübner & Co., London.

,, —1903. "Tetraxonia." Das Thierreich. Lief. XIX, Porifera.

,, —1906. "Die Tetraxonia." Wiss. Ergebn. deutsch. Tiefsee-Exp. Bd. XI, Lief 2.

,, —1910. "The Geodiidæ." Reports on the Scientific Results of the "Albatross" Expedition. XXI, The Sponges, pp. 1–260.

LUNDBECK, W.—1905. "Desmacidonidæ (Pars)." Porifera, Pt. II. Danish Ingolf-expedition. Vol. VI, No. 2.

,, —1910. "Desmacidonidæ (Pars)." Porifera, Part III. Danish Ingolf-expedition. Vol. VI, No. 3.

MARSHALL, W.—1880. "Untersuchungen über Dysideiden und Phoriospongien." Zeitschr. f. wiss. Zool. Bd. XXXV, pp. 88–129.

NORMAN, A. M.—1882. "A Monograph of the British Spongiadæ." Bowerbank. Vol. IV.

POLÉJÆFF, N. de.—1883. "Report on the Calcarea." "Challenger" Reports, Zoology. Vol. VIII.

RIDLEY, S. O.—1881. "Spongida collected during the Expedition of H.M.S. 'Alert' in the Straits of Magellan and on the Coast of Patagonia." Proc. Zool. Soc. London, 1881, pp. 107–139.

,, —1883. "Notes on Zoophytes and Sponges collected by Mr. F. Day on the East Coast of Scotland." Journ. Linn. Soc. Zool. Vol. XVII, pp. 105–108.

,, —1884. "Spongiida." Report on the Zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert," 1881–2, pp. 366–482, 582–630.

RIDLEY, S. O. and DENDY, A.—1887. "Report on the Monaxonida." "Challenger" Reports, Zoology. Vol. XX.

SCHMIDT, O.—1862. "Die Spongien des adriatischen Meeres." Leipzig.

,, —1875. "Spongien." Zool. Ergebn. der Nordseefahrt 1872. Kiel, Deutsch. Meer. Ber. Vols. II and III, pp. 115–120.

,, —1879. "Die Spongien des Meerbusens von Mexico," &c. I. Heft, Jena.

Sollas, W. J.—1886. "Preliminary account of the Tetractinellid Sponges dredged by H.M.S. 'Challenger,' 1872-6. Part I. The Choristida." Proc. Dublin Soc. Vol. V, pp. 177-199.

,, —1888. "Report on the Tetractinellida." "Challenger" Reports, Zoology. Vol. XXV.

Stephens, Jane—1912. "Clare Island Survey." Part LIX. Marine Porifera. Proc. Roy. Irish Acad. Vol. XXXI, No. 59.

,, —1916. "Preliminary Notice of some Irish Sponges," &c. Ann. Mag. Nat. Hist. (8) XVII, pp. 232-242.

,, —1921. "Sponges of the Coasts of Ireland. II. The Tetraxonida" (concluded). Fisheries, Ireland, Sci. Invest. 1920.

Thiele, J.—1898. "Studien über pacifische Spongien, I." Zoologica, Heft 24.

,, —1900. "Kieselschwämme von Ternate, I." Abh. Senckenb. Nat. Ges. Bd. XXV, pp. 17-80.

,, —1903 a. "Beschreibung einiger unzureichend bekannten monaxonen Spongien." Arch. Naturg. Jahrg. 69. Bd. I, pp. 375-398.

,, —1903 b. "Kieselschwämme von Ternate, II." Abh. Senckenb. Nat. Ges. Bd. XXV, pp. 933-968.

,, 1905. "Die Kiesel- und Hornschwämme der Sammlung Plate." Zool. Jahrb. Suppl. VI, pp. 407-496.

Topsent, E.—1891. "Essai sur la Faune des Spongiaires de Roscoff." Arch. Zool. Exp. et Gén. (2), IX, pp. 523-554.

,, —1892. "Contributions à l'Étude des Spongiaires de l'Atlantique Nord." Camp. Scient. du Prince de Monaco, Fasc. II.

,, —1893. "Nouvelle Série de Diagnoses d'Éponges de Roscoff et de Banyuls." Arch. Zool. Exp. et Gén. (3), I, pp. xxxiii-xliii.

,, —1896. "Matériaux pour servir à l'Étude de la Faune des Spongiaires de France." Mém. Soc. Zool. France, IX, 1, pp. 113-133.

,, —1897. "Spongiaires de la Baie d'Amboine." Rev. Suisse Zool. Vol. IV, pp. 421-487.

,, —1900. "Étude monographique des Spongiaires de France. III. Monaxonida (Hadromerina)." Arch. Zool. Exp. et Gén. (3), VIII, pp. 1-331.

,, —1901. "Spongiaires." Résult. Voyage Belgica, Zool.

,, —1903. "Sur les Larves cuirassées de Thoosa armata." Arch. Zool. Exp. et Gén. (4), I, pp. i-iii.

,, —1904. "Spongiaires des Açores." Camp. Scient. du Prince de Monaco, Fasc. XXV.

,, —1908. "Spongiaires." Expédition antarctique française, 1903-5. Paris.

,, —1913 a. "Spongiaires provenant des Campagnes Scientifiques de la Princesse-Alice dans les Mers du Nord." Camp. Scient. du Prince de Monaco, Fasc. XLV.

,, —1913 b. "Spongiaires de l'Expédition antarctique nationale écossaise." Trans. Roy. Soc. Edinburgh. Vol. XLIX, Pt. 3, No. 9.

,, —1920. "Caractéres et Affinités des Thoosa," &c. Bull. Soc. Zool. de France, T. XLV, pp. 88-97.

Vosmaer, G. C. J.—1880. "The Sponges of the Leyden Museum. I. The Family of the Desmacidinæ." Notes from the Leyden Museum. Vol. II, pp. 157-164.

,, —1885. "The Sponges of the 'Willem Barents' Expedition." Bijdr. Dierk. Aflev. 12.

Whitelegge, T.—1907. "Scientific Results of the Trawling Expedition of H.M.C.S. 'Thetis' off the Coast of New South Wales. Sponges (continued)." Australian Museum, Mem. IV, pp. 487-515.

Wilson, H. V.—1894. "Observations on the Gemmule and Egg Development of Marine Sponges." Journal of Morphology, Vol. IX, No. 3, pp. 277-406.

,, —1904. "The Sponges." Reports on the "Albatross" Expedition off the West Coasts of Mexico, &c. XXX. Mem. Mus. Comp. Zool. Harvard Coll. Vol. XXX, No. 1, pp. 1-164.

INDEX.

aberrans, Phlœodictyon, 333.
Acanthella, 336.
acervus, Ancorina, 303.
,, Ecionemia, 303.
Aciculites higginsii, 316.
,, pulchra, 315.
,, orientalis, 316.
alata, Ancorina, 298, 301.
,, Ecionemia, 301.
Alectona millari, 316, 317.
(Algol) corticata, 307.
americana, Esperiopsis, 340.
Amphiastrella birotulifera, 372.
,, kirkpatricki, 371, 373.
Amphilectus edwardii, 340.
,, gracilis, 340.
Amphoriscus poculum, 280.
Anchinoë fristedti, 359.
,, novæ-zealandiæ, 360.
Ancorina acervus, 303.
,, alata, 298, 301.
,, diplococcus, 297, 373.
,, novæ-zealandiæ, 301.
,, osculifera, 300.
,, progressa, 297, 373.
,, stalagmoides, 297, 345, 346.
anomalus, Microtylostylifer, 382.
antarctica, Guitarra, 336.
Aphroceras syconoides, 284.
arborea, Chalinopsilla, 331.
arcifera, Oceanapia, 332.
arenaria, Myxilla, 362.
armata, Thoosa, 317.
armigera, Cladochalina, 327.
Artemisina, 342.
,, elegantula, 344.
,, jovis, 343.
asigmata, Lissodendoryx, 362.
Asteropus hæckeli, 306.
,, simplex, 306, 345.
Astrella tuberosa, 291.
Astrotetraxonida, 290.
aurantiaca, Cladochalina, 326.
,, Pachychalina, 326.
australis, Histodermella, 297, 373.
Axinella erecta, 351.
Axinellinæ, 374.

Barbozia, 376.
Biemna chilensis, 347.
Biemna, macrorhaphis, 347.
,, megalosigma, 346.
,, novæ-zealandiæ, 346.
,, trirhaphis, 346.
bilamellata, Cavochalina, 323.
birotulifera, Amphiastrella, 372.
bistellata, Stelletta, 291.
bowerbankii, Craniella, 318.
Bubaris elegans, 350.
,, ornata, 351.
,, oxeata, 349, 350, 351.
,, sosia, 350.
,, vermicularis, 351.
,, vermiculata, 351.

Calcarea, 275.
calyx, Gellius, 323, 324.
carnosus, Suberites, 380.
cavicornuta, Isodictya, 335.
Ceraochalina bilamellata, 323.
,, papillata, 327, 328.
,, pergamentacea, 327.
Chalina novæ-zealandiæ, 326.
,, oculata, 326.
,, polychotoma, 326.
,, pergamentacea, 327.
,, ramosa, 326.
chaliniformis, Dactylia, 332.
Chalininæ, 326.
Chalinopsilla arborea, 331.
,, macroposa, 331.
,, palmata, 331.
chilensis, Biemna, 347.
Chondrilla nucula, 314.
Chondropsis, 362.
,, kirkii, 363.
Chondrosiidæ, 314.
Cinachyra uteoides, 318.
Cladochalina armigera, 327.
,, aurantiaca, 326.
,, pergamentacea, 327.
Clathria scotti, 347, 352.
,, terræ-novæ, 353.
Clathrieæ, 349.
clathrodes, Plumohalichondria, 361.
Clavulidæ, 376.
Cliona, 316.
Cœlosphæreæ, 370.
columna, Stelletta, 294, 345.
columnata, Esperiopsis, 345.

communis, Siphonochalina, 328.
„ Tubulodigitus, 328.
conigera, Polymastia, 381.
Coppatias distinctus, 306.
Coppattiidæ, 308.
coralloides, Petrosia, 324.
„ Rhabderemia, 357.
coriacea, Stellettinopsis, 305.
corrugata, Crateromorpha, 285.
corticata, Algol, 307.
„ Leucettusa, 278.
„ Stellettinopsis, 307.
Craniella bowerbankii, 318.
„ cranium, 318.
„ simillima, 318.
„ zetlandica, 318.
cranium, Craniella, 318.
„ Tethya, 318.
crater, Stelletta, 292, 298, 345, 308.
Crateromorpha corrugata, 285.
Crellomyxilla, 363.
„ intermedia, 364.
crista-galli, Tedania, 365.
cunninghami, Esperia, 336.
curvichela, Hymedesmia, 359.
Cydonium japonica, 312.
cylindrica, Geodinella, 313.

Dactylia chaliniformis, 332.
„ palmata, 331.
Darwinellidæ, 382.
decora, Esperiopsis, 342.
demonstrans, Pyloderma, 370, 372.
Dendrilla elegans, 382.
dendyi, Dorypleres, 306.
„ Jaspis, 306.
Desmacella, 293, 294, 295, 296.
„ peachi, 346.
„ trirhaphis, 346.
„ vestibularis, 295, 298, 306, 345.
Desmacidonidæ, 334.
digitata, Spongia, 334.
diplococcus, Ancorina, 297, 373.
Discodermia, 316.
Discorhabdella, 376.
„ incrustans, 376.
distinctus, Coppatias, 306.
„ Jaspis, 306.
diversiancorata, Myxilla, 362.
Dorypleres dendyi, 306.
Dotona pulchella, 379.
Dotonella, 379.
„ mirabilis, 379.
Dysidea hirciniformis, 383.

Echinaxia, 356.
Ecionemia acervus, 303.
„ alata, 301.
Ectyoninae, 347.
edwardii, Amphilectus, 340.
„ Esperiopsis, 340.
„ Isodictya, 340.
elastica, Spongelia, 330.
elegans, Bubaris, 350.
„ Dendrilla, 382.
„ Megalopastas, 382.
elegantula, Artemisina, 344.
erecta, Axinella, 351.
Esperella magellanica, 336.
„ murrayi, 340.
Esperellinæ, 334.
Esperia cunninghami, 336.
„ magellanica, 336.
„ placoides, 340.
Esperiopsis americana, 340.
„ columnata, 345.
„ decora, 342.
„ edwardii, 340.
„ flagellum, 342.
„ macrosigma, 341.
„ megachela, 341.
„ novæ-zealandiæ, 341.
Euceratosa, 382.
Euchalinopsis oculata, 326.
Euplectellidæ, 287.

Ficulina ficus, 380.
ficus, Ficulina, 380.
fistulosa, Inflatella, 373.
fistulosum, Phlœodictyon, 332.
flagellifer, Gellius, 320, 342.
flagellum, Esperiopsis, 342.
fœtidus, Tedanione, 367.
fragilis, Spongelia, 383.
fristedti, Anchinoë, 359.
Fusifer, 376.

Gelliinæ, 320.
Gellius calyx, 323, 324.
„ flagellifer, 320, 342.
„ imperialis, 322.
„ petrocalyx, 321.
„ tubuloramosus, 323.
Geodia, 284.
„ japonica, 312.
„ regina, 308, 311, 312.
„ rex, 311.
Geodiidæ, 308.
Geodinella, 313.
„ cylindrica, 313.
„ robusta, 313.
„ vestigifera, 313.
glabra, Ute, 284.
gracilis, Amphilectus, 340.
„ Isodictya, 340.
Grantessa poculum, 280.
Grantia, ramulosa, 281.
Grantiidæ, 281.
guernei, Rhabderemia, 358.
Guitarra, 336.
„ antarctica, 336.
„ novæ-zealandiæ, 336.

hæckeli, Asteropus, 306.
Halichondria latrunculioides, 370.
„ magellanica, 325.

Halichondria nigricans, 348.
„ pattersoni, 348.
„ scandens, 347.
Halicnemia patera, 381.
Haploscleridæ, 320.
helgæ, Hymedesmia, 359.
Hemitedania, 366.
Heteropia patulosculifera, 280.
Heteropiidæ, 280.
Heteroxyeæ, 374.
Hexactinellida, 284.
higginsii, Aciculites, 316.
hirciniformis, Dysidea, 383.
„ Spongelia, 383.
Histodermella australis, 297, 373.
„ ingolfii, 373, 374.
Homocœlidæ, 275.
Homœodictya, 336.
Hymedesmia curvichela, 359.
„ helgæ, 359.
„ kœhleri, 359.
„ lacera, 359.
„ lophastræa, 307.
„ lundbecki, 358.
„ similis, 359.
Hymedesmieæ, 358.
Hymeraphia stellifera, 376.
„ vermiculata, 351.
Hymerhabdia oxytrunca, 349.
hyndmanni, Isodictya, 347.

ijimai, Rossella, 284.
imperfecta, Leucettusa, 278.
imperialis, Gellius, 322.
implicita, Isodictya, 347.
inæqualis, Raspailia, 355.
incrustans, Discorhabdella, 376.
Inflatella, 370, 372.
„ fistulosa, 373.
„ spherica, 372, 373.
ingolfi Histodermella, 373, 374.
intermedia, Crellomyxilla, 364.
„ Siphonochalina, 328.
Iophon, 347.
„ lævistylus, 347.
„ nigricans, 347.
Iophoneæ, 347.
Iophonopsis, 347, 348.
Isodictya, 334.
„ cavicornuta, 335.
„ edwardii, 340.
„ gracilis, 340.
„ hyndmanni, 347.
„ implicita, 347.
„ normani, 334.
„ palmata, 334, 336.
„ paupera, 340.
Isodictyeæ, 334.

japonica, Cydonium, 312.
„ Geodia, 312.
Jaspis dendyi, 306.
„ distinctus, 306.
Jaspis novæ-zealandiæ, 291, 305, 336.
jovis, Artemisina, 343.

kirkii, Chrondropsis, 363.
„ Phoriospongia, 363.
kirkpatricki, Amphiastrella, 371, 373.
„ Oceanapia, 366.
„ Tedaniopsis, 370.
kœhleri, Hymedesmia, 359.

lacera, Hymedesmia, 359.
lævispirulifer, Trachycladus, 378.
lævistylus, Iophon, 347.
lancifer, Leucettusa, 278.
latituba, Siphonochalina, 329.
latrunculioides, Halichondria, 37 .
„ Pyloderma, 372.
Lepidospongia, 316.
Leucaltidæ, 276.
Leucetta saccharata, 283.
Leucettusa corticata, 278.
„ imperfecta, 278.
„ lancifer, 278.
„ tubulosa, 276, 279, 280.
Leucosolenia stolonifer, 275.
lilliei, Mycale, 337, 376.
lingua, Mycale, 340.
Lissodendoryx asigmata, 362.
„ spongiosa, 362.
Lithistidæ, 315.
lobata, Stelletta, 300.
lophastræa, Hymedesmia, 307.
lundbecki, Hymedesmia, 358.
lutea, Stellettinopsis, 305.

macropora, Chalinopsilla, 331.
macrorhaphis, Biemna, 347.
macrosigma, Esperiopsis, 341.
magellanica, Esperella, 336.
„ Esperia, 336.
„ Halichondria, 325.
„ Mycale, 336, 338, 376.
mammillata, Sigmaxinella, 358.
maori, Stelletta, 290, 291.
megachela, Esperiopsis, 341.
Megalopastas elegans, 382.
megalosigma, Biemna, 346.
Mesapos, 376.
Microcona, 354.
Microtylostylifer, 381.
„ anomalus, 382.
millari, Alectona, 316, 317.
minor, Siphonochalina, 328.
mirabilis, Dotonella, 379.
murrayi, Esperella, 340.
„ Mycale, 339, 340.
Mycale lilliei, 337, 376.
„ lingua, 340.
„ magellanica, 336, 338, 376.
„ murrayi, 339, 340.
„ novæ-zealandiæ, 339.
„ placoides, 339, 340.
Mycaleæ, 336.

Myxilla arenaria, 362.
„ diversiancorata, 362.
„ novæ-zealandiæ, 361.
„ pedunculata. 362.
„ pluridentata, 362.
„ spongiosa, 362.
Myxilleæ, 359.

nigricans, Halichondria, 348.
„ Iophon, 347.
normani, Isodictya, 334.
novæ-zealandiæ, Anchinoë, 360.
„ Ancorina, 301.
„ Biemna, 346.
„ Chalina, 326.
„ Esperiopsis, 341.
„ Guitarra, 336.
„ Jaspis, 291, 305, 336.
„ Mycale, 339.
„ Myxilla, 361.
„ Spongosorites, 307.
„ Suberites, 380.
nucula, Chondrilla, 314.

Oceanapia arcifera, 332.
„ kirkpatricki, 366.
„ tantula, 366.
„ toxophila, 332.
oculata, Chalina, 326.
„ Euchalinopsis 326.
orientalis, Aciculites, 316.
ornata, Bubaris, 351.
osculifera, Ancorina, 300.
oxeata, Bubaris, 249, 350, 351.
oxytrunca, Hymerhabdia, 349.

Pachychalina aurantiaca, 326.
palmata, Chalinopsilla, 331.
„ Dactylia, 331.
„ Isodictya, 334, 336.
papillata, Ceraochalina, 327, 328.
Parahigginsia, 374.
„ phakellioides, 375.
patera, Halicnemia, 381.
pattersoni, Halichondria, 348.
Patuloscula procumbens, 328.
patulosculifera, Heteropia, 280.
paupera, Isodictya, 340.
peachi, Desmacella, 346.
pedunculata, Myxilla, 362.
Penares tylotaster, 303.
pergamentacea, Ceraochalina, 327.
„ Chalina, 327.
„ Cladochalina, 327.
petrocalyx, Gellius, 321.
Petrosia coralloides, 324.
Phakellia, 323, 324, 325, 374.
phakellioides, Parahigginsia, 375.
Phlœodictyinæ, 332.
Phlœodictyon, 368.
„ aberrans, 333.
„ fistulosum, 332.
Phoriospongia, 362.
Phoriospongia kirkii, 363.
phrissens, Stelletta, 291, 292.
placoides, Esperia, 340.
„ Mycale, 339, 340.
Plumohalichondria, 361.
„ clathrodes, 361.
pluridentata, Myxilla, 362.
Pocillon, 347.
poculum, Amphoriscus, 280.
„ Grantessa, 280.
polychotoma, Chalina, 326.
Polymastia conigera, 381.
procumbens, Siphonochalina, 328.
„ Patuloscula, 328.
progressa, Ancorina, 297, 373.
Psammochela, 362.
pulchella, Dotona, 379.
pulchra, Aciculites, 315.
purpurea, Stellettinopsis, 305.
Pyloderma, 370.
„ demonstrans, 370, 372.
„ latrunculioides, 372.

ramosa, Chalina, 326.
„ Spongia, 326.
ramulosa, Grantia, 281.
Raspailia inæqualis, 355.
„ topsenti, 354, 356.
Raspaxilla, 355, 356.
regalis, Siphonochalina, 328.
regina, Geodia, 308, 311, 312.
Reniera, 325.
Renierinæ, 324.
rex, Geodia, 311.
Rhabderemia coralloides, 357.
„ guernei, 358.
„ spinosa, 357.
Rhabdosigma, 358.
Rhaphidhistia spectabilis, 379.
Rhaphidophlus tenebratus, 353.
robusta, Geodinella, 313.
Rossella ijimai, 284.
Rossellidæ, 284, 287.
rowi, Symplectella, 287.

saccharata, Leucetta, 283.
scandens, Halichondria, 347.
scotti, Clathria, 347, 352.
Sigmatotetraxonida, 315.
Sigmaxinella mammillata, 358.
similis, Hymedesmia, 359.
simillima, Craniella, 318.
„ Tethea, 318.
simplex, Asteropus, 306, 345.
„ Stellettinopsis, 306.
Siphonochalina communis, 328.
„ intermedia, 328.
„ latituba, 329.
„ minor, 328.
„ procumbens, 328.
„ regalis, 328.
„ stellidermata, 330.
sosia, Bubaris, 350.

spectabilis, Rhaphidhistia, 379.
spherica, Inflatella, 372, 373.
spiculivora, Spongelia, 384.
spinosa, Rhabderemia, 357.
Spirastrellinæ, 376.
Spongelia elastica, 330.
,, fragilis, 383.
,, hirciniformis, 383.
,, spiculivora, 384.
,, stellidermata, 330.
Spongeliidæ, 383.
Spongia digitata, 334.
,, ramosa, 326.
spongiosa, Lissodendoryx, 362.
,, Myxilla, 362.
Spongosorites novæ-zealandiæ, 307.
stalagmoides, Ancorina, 297, 345, 346.
Stelletta bistellata, 291.
,, columna, 294, 345.
,, crater, 292, 298, 308, 345.
,, lobata, 300.
, maori, 290, 291.
,, phrissens, 291, 292.
,, tuberosa, 291.
,, vestigium, 313.
Stellettidæ, 290.
Stellettinopsis coriacea, 305.
,, corticata, 307.
,, lutea, 305.
,, purpurea, 305.
,, simplex, 306.
stellidermata, Siphonochalina, 330.
,, Spongelia, 330.
stellifera, Hymeraphia, 376.
stolonifer, Leucosolenia, 275.
stylifer, Trachycladus, 377, 378.
Suberites carnosus, 380.
,, novæ-zealandiæ, 380.
syconoides, Aphroceras, 284.
,, Ute, 284.
Symplectella, 286.
,, rowi, 287.

tantula, Oceanapia, 366.
Tedania crista-galli, 365.
Tedanieæ, 365.
Tedanione, 367.
,, fœtidus, 367.
Tedaniopsis, 366.
,, kirkpatricki, 370.
,, turbinata, 278, 366, 367.
tenebratus, Rhaphidophlus, 353.
terræ-novæ, Clathria, 353.
Tethea simillima, 318.
Tethya cranium, 318.
,, zetlandica, 318.
Tethyopsilla zetlandica, 318.
Tetillidæ, 318.
Tetraxonida, 290.
Thoosa armata, 317.
topsenti, Raspailia, 354, 356.
toxophila, Oceanapia, 332.
Trachycladus lævispirulifer, 378.
,, stylifer, 377, 378.
trirhaphis, Biemna, 346.
,, Desmacella, 346.
tuberosa, Astrella, 291.
,, Stelletta, 291.
Tubulodigitus communis, 328.
tubuloramosus, Gellius, 323.
tubulosa, Leucettusa, 276, 279, 280.
turbinata, Tedaniopsis, 278, 366, 367.
Tylodesma vestibularis, 345.
tylotaster, Penares, 303.

Ute glabra, 284.
,, syconoides, 284.
uteoides, Cinachyra, 318.

vermicularis, Bubaris, 351.
vermiculata, Bubaris, 351.
,, Hymeraphia, 351.
vestibularis, Desmacella, 295, 298, 306, 345.
,, Tylodesma, 345.
vestigifera, Geodinella, 313.
vestigium, Stelletta, 313.

zetlandica, Craniella, 318.
,, Tethya, 318.
,, Tethyopsilla, 318.

Printed in England at the Oxford University Press by Frederick Hall

PLATE I.

FIGS. 1–10.—*Leucettusa tubulosa*, n. sp.

FIG. 1.—R. N. XIX. 2. External form. Nat. size.
FIG. 2.—R. N. XIX. 3. External form. Nat. size.
FIG. 3.—R. N. XIX. 2. Large quadriradiates. × 48.
FIG. 4.—R. N. XIX. 2. Large triradiates. × 48.
FIG. 5.—R. N. XIX. 2. Reduced pigmy radiates with only two rays, from interior. × 450.
FIG. 6.—R. N. XIX. 2. Pigmy quadriradiates from near margin of vent. × 450.
FIG. 7.—R. N. XIX. 2. Pigmy quadriradiate from interior, with separating rays. × 450.
FIG. 8.—R. N. XIX. 2. Pigmy triradiates from interior. × 450.
FIG. 9.—R. N. XIX. 2. Sagittal triradiates. × 48.
FIG. 10.—R. N. XIX. 2. Pigmy triradiates from margin of vent. × 450.

FIGS. 11–18.—*Leucettusa lancifer*, n. sp.

FIG. 11.—R. N. XIV. 2. Pigmy quadriradiates from interior. × 450.
FIG. 12.—R. N. XLIII. Pigmy triradiates from interior. × 450.
FIG. 13.—R. N. XIV. 2. Large triradiates. × 48.
FIG. 14.—R. N. XIV. 2. Reduced pigmy radiates. × 450.
FIG. 15.—R. N. XIV. 2. Pigmy triradiate from interior. × 450.
FIG. 16.—R. N. XLIII. External form. Nat. size.
FIG. 17.—R. N. XIV. 2. External form. Nat. size.
FIG. 18.—R. N. XIV. 2. Pigmy quadriradiates from interior. × 450.

FIG. 19.—*Grantessa poculum* (Poléjaeff).

FIG. 19.—R. N. XIX 1 *a*. Lance-headed oxeote. × 90.

Brit. Mus (Nat Hist)
Brit. Antarctic (Terra Nova) Exped. 1910.
Zoology, Vol. VI.
Porifera, Part I, Pl. I.

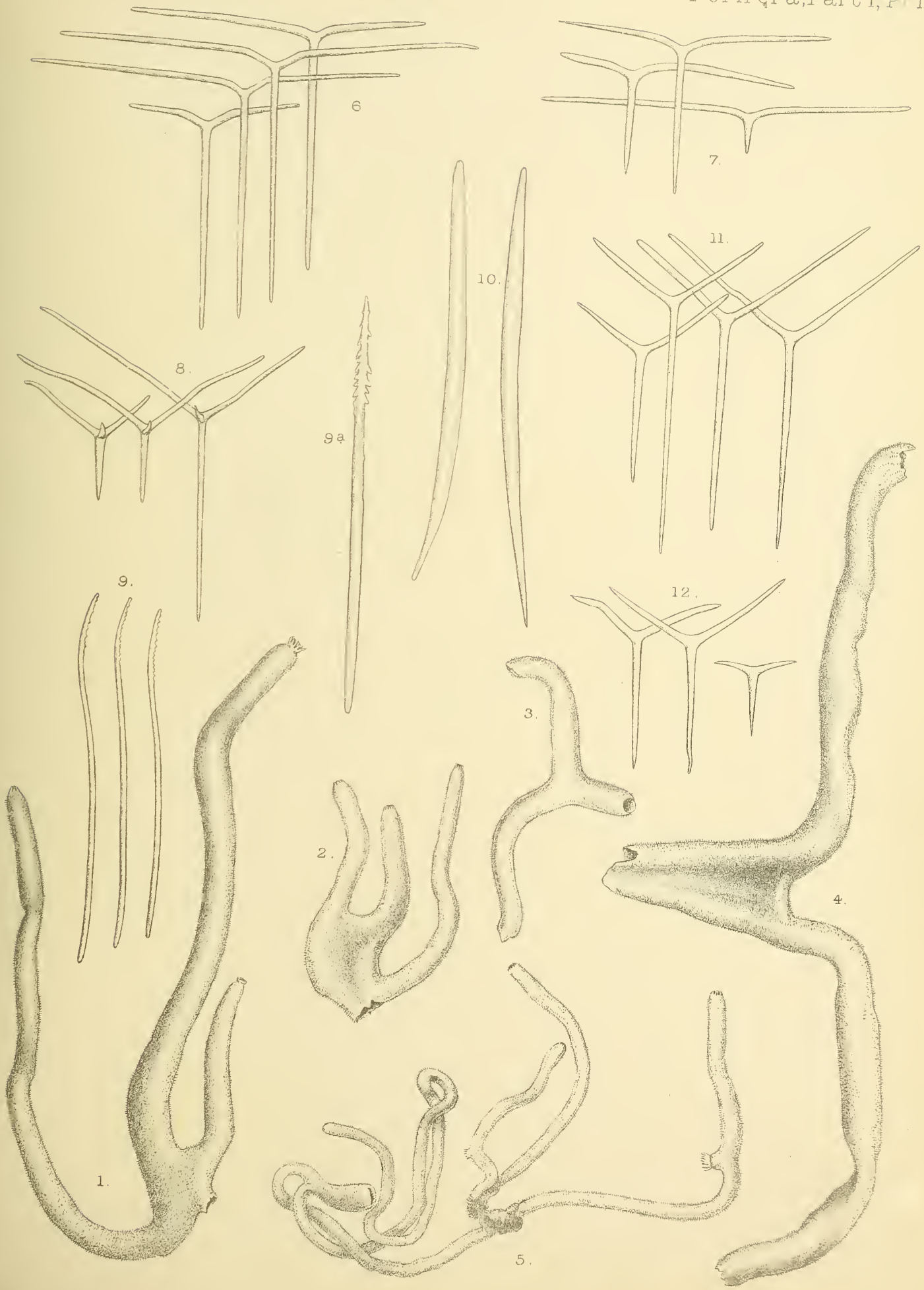
Arthur Dendy and T P C del

PLATE II.

Grantia ramulosa, n. sp. (R. N. XVI).

Figs. 1–5.—Pieces selected to show the range in external form. × 2.
Fig. 6.—Subgastral sagittal triradiates. × 160.
Fig. 7.—Alate triradiates of the oscular skeleton. × 160.
Fig. 8.—Gastral quadriradiates. × 160.
Fig. 9.—Saw-like oxea, side views. × 280.
Fig. 9 *a*.—Saw-like oxeote (small specimen), front view. × 650.
Fig. 10.—Large oxea. × 160.
Fig. 11.—Dermal triradiates. × 160.
Fig. 12.—Triradiates of chamber layer (drawn from spicules *in situ*). × 160.

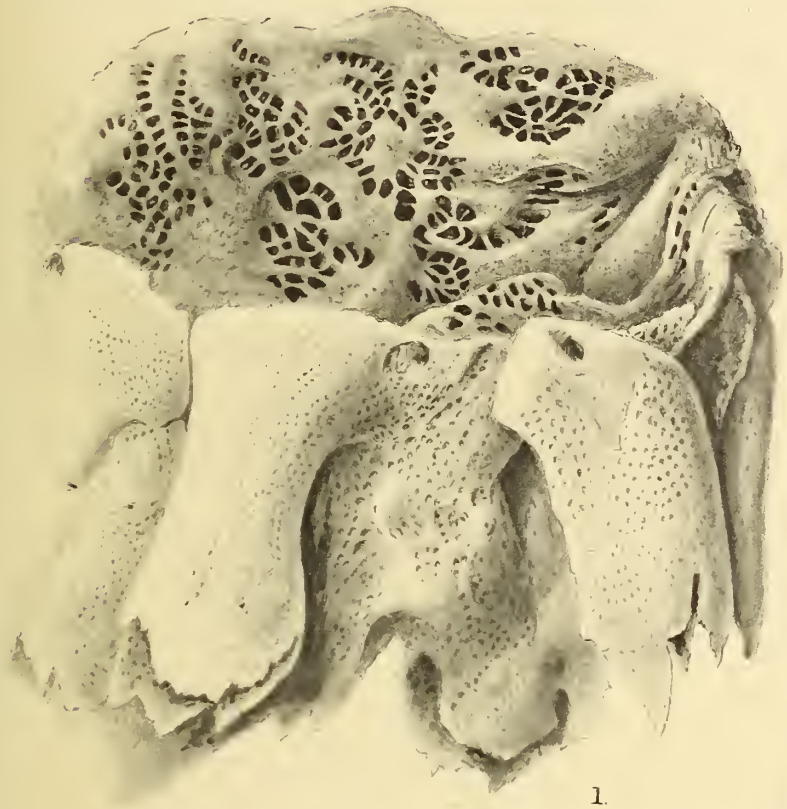
The spicules, with the exception of those shown in Fig. 12, were drawn from boiled-out preparations, so that their position in the sponge could only be inferred from their shape.



Arthur Dendy & T. P. C. del.

PLATE III.

FIG. 1.—*Symplectella rowi*, n. gen. et sp. R. N. XV. × $\frac{1}{2}$.
FIG. 2.—*Symplectella rowi*, n. gen. et sp. R. N. XXVI. A younger specimen. Nat. size.
FIG. 3.—*Symplectella rowi*, n. gen. et sp. R. N. XXVI. Another view. Nat. size.
FIG. 4.—*Ancorina stalagmoides*, n. sp. R. N. XXXIII. 1. × $\frac{2}{3}$.
FIG. 5.—*Rossella ijimai*, n. sp. R. N. XVIII. 1. Nat. size.



1.

2.

3.

4.

5.

BRITISH MUSEUM
NATURAL HISTORY

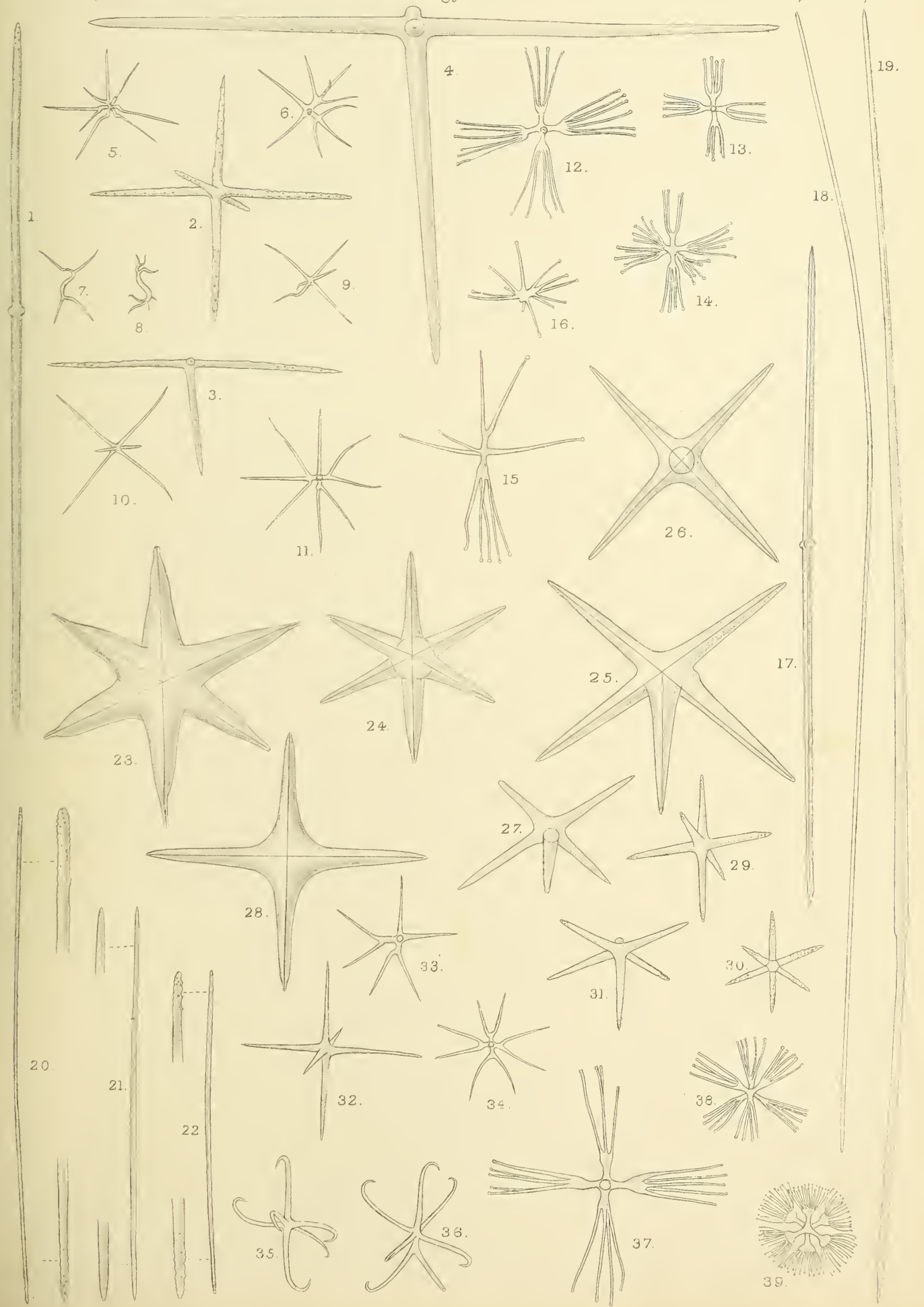
PLATE IV.

Figs. 1–16.—*Rossella ijimai*, n. sp. (R. N. XVIII. 1).

Fig. 1.—Small diact. × 280.
Fig. 2.—Gastral hexact (*in situ*). × 280.
Fig. 3.—Gastral pentact (*in situ*). × 280.
Fig. 4.—Pentact. × 280.
Figs. 5–11.—Oxyhexasters. × 370.
Figs. 12–15.—Calycocomes. × 370.
Fig. 16.—Irregular discohexaster. × 370.

Figs. 17–39.—*Symplectella rowi*, n. gen. et sp. (R. N. XV).

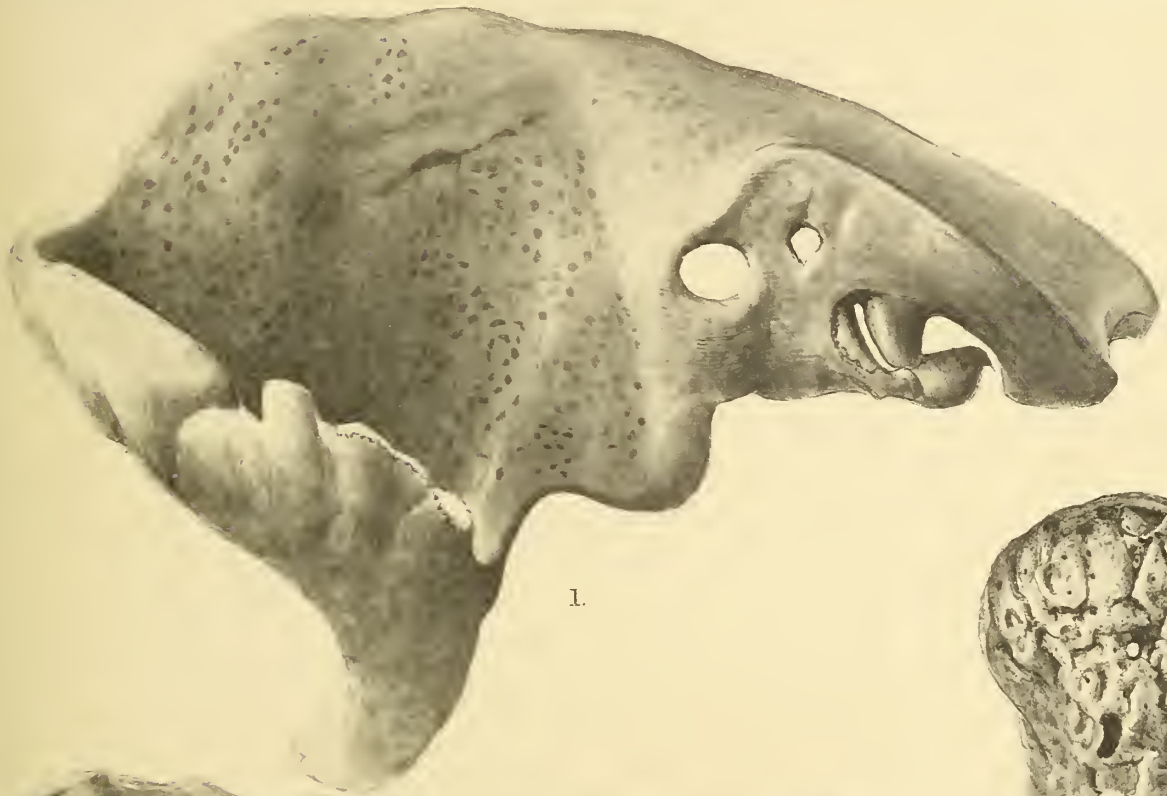
Fig. 17.—Small diact with central inflation. × 160.
Fig. 18.—Slender diact. × 65.
Fig. 19.—Stout diact. × 60.
Figs. 20–22.—Small diacts. × 65; their ends also drawn separately. × 280.
Fig. 23.—Large hexact, parenchymal type. × 160.
Fig. 24.—Medium-sized hexact, dermal type. × 160.
Figs. 25–27.—Pentacts. × 160.
Fig. 28.—Stauract. × 160.
Figs. 29, 30.—Small hexacts with roughened tips. × 160.
Fig. 31.—Small pentact with three roughened tips. × 160.
Fig. 32.—Dermal oxyhexact (oxyhexaster). × 370.
Figs. 33, 34.—Oxyhexasters. × 370.
Figs. 35, 36.—Oxyhexasters with curved rays. × 370.
Fig. 37.—Larger calycocome. × 370.
Fig. 38.—Smaller calycocome. × 370.
Fig. 39.—Very minute discohexaster. × 1100.


1
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15
16.
17.
18.
19.
20.
21.
22
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.
35.
36.
37.
38.
39.

FIELD MUSEUM OF NATURAL HISTORY

PLATE V.

FIG. 1.—*Ancorina alata*, n. sp. R. N. XXXII. 6. × $\frac{2}{3}$.
FIG. 2.—*Ancorina alata*, n. sp. R. N. XXXII. 8. × $\frac{2}{3}$.
FIG. 3.—*Mycale novæ-zealandiæ*, n. sp. R. N. XXIV. Nat. size.
FIG. 4.—*Stelletta columna*, n. sp. R. N. XXXII. 4. × $\frac{1}{2}$.
FIG. 5.— *Geodia regina*, n. sp. R. N. XXXII. 3. × $\frac{2}{3}$.



1.

3.

2.

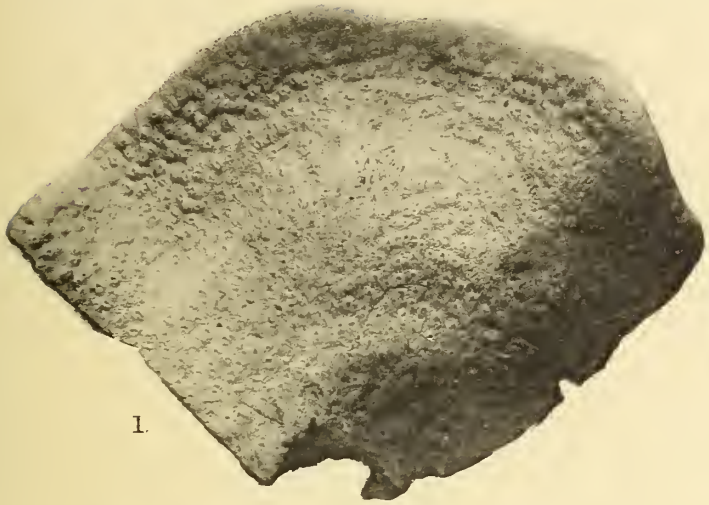
4.

5.

BRITISH MUSEUM
NATURAL HISTORY

PLATE VI.

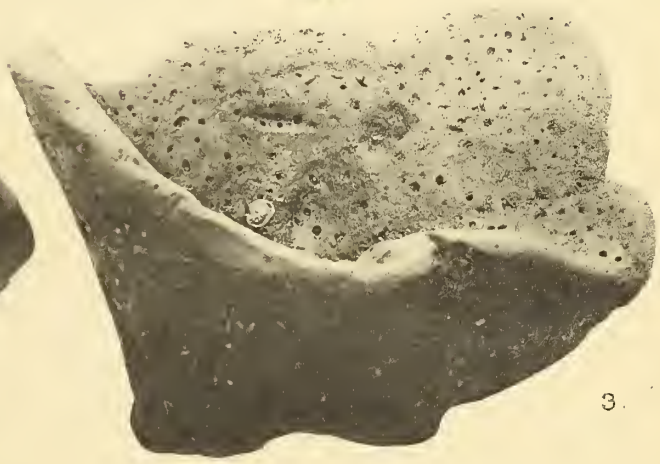
FIG. 1.—*Aciculites pulchra*, n. sp. R. N. LVI. *b*. Part of specimen. Upper surface. Nat. size.
FIG. 1 *a*.—*Aciculites pulchra*, n. sp. R. N. LVI. *b*. Part of specimen. Lower surface. Nat. size.
FIG. 2.—*Gellius petrocalyx*, n. sp. R. N. XXXII. 1. × $\frac{2}{3}$.
FIG. 3.—*Gellius petrocalyx*, n. sp. R. N. XXXII. 9. × $\frac{2}{3}$.
FIG. 4.—*Geodia rex*, n. sp. R. N. XXXIII. 4. × $\frac{1}{2}$.



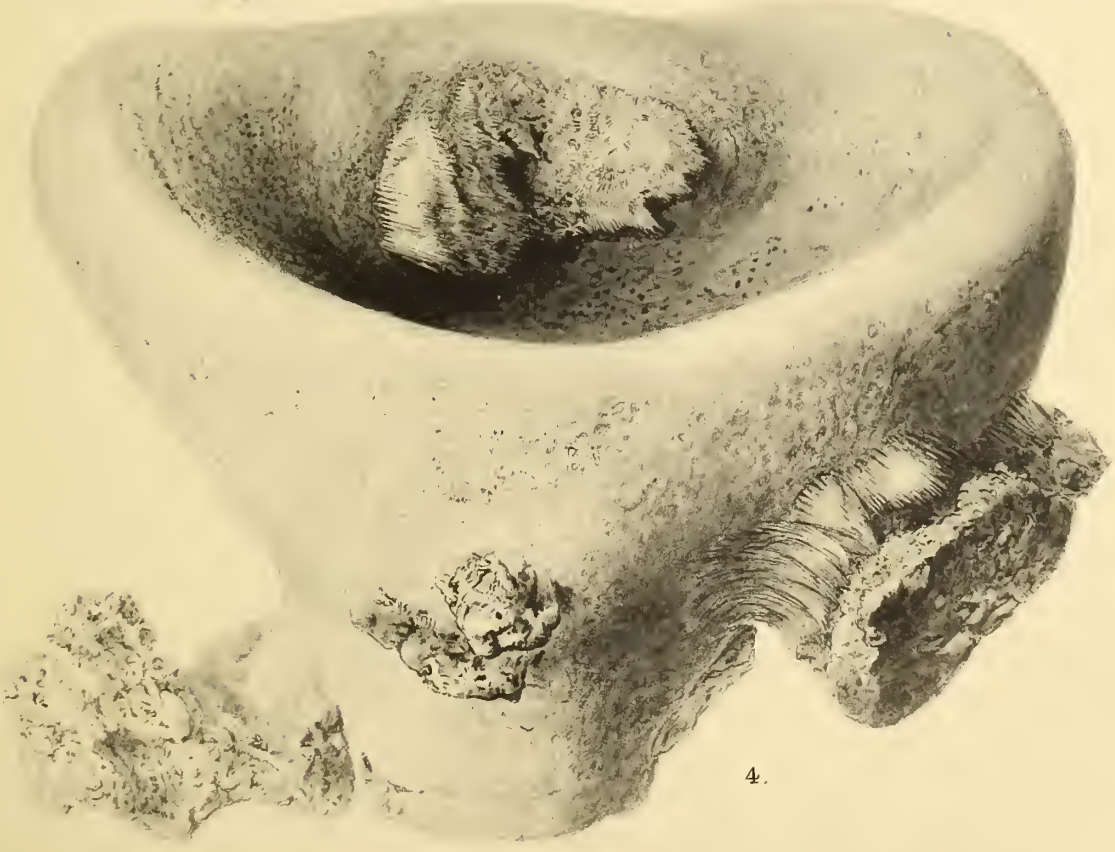
1.

2.

1a.



3.



4.

MUSEUM

PLATE VII.

Figs. 1–4.—*Stelletta columna*, n. sp. (R. N. XXXII. 4).

Fig. 1.—Plagiotriæne. × 50.
Fig. 2.—Oxeote. × 50.
Fig. 3.—Large oxyspherasters. × 280.
Fig. 4.—Minute oxyspherasters. × 280.

Figs. 5–7.—*Stelletta crater*, n. sp. (R. N. XXXII. 15).

Fig. 5.—Oxeote. × 64.
Fig. 6.—Triænes. × 64.
Fig. 6 *a*.—Triæne with blunted cladi. × 64.
Fig. 6 *b*.—Diæne. × 64.
Fig. 7.—Oxyspherasters. × 440

Figs. 8–11.—*Stelletta maori*, n. sp. (R. N. L. 10).

Fig. 8.—Dichotriænes. × 50.
Fig. 9.—Oxea. × 50.
Fig. 10.—Oxyasters. × 440
Fig. 11.—Tylasters. × 440.

Figs. 12–15.—*Ancorina stalagmoides*, n. sp. (R. N. XXXIII. 1).

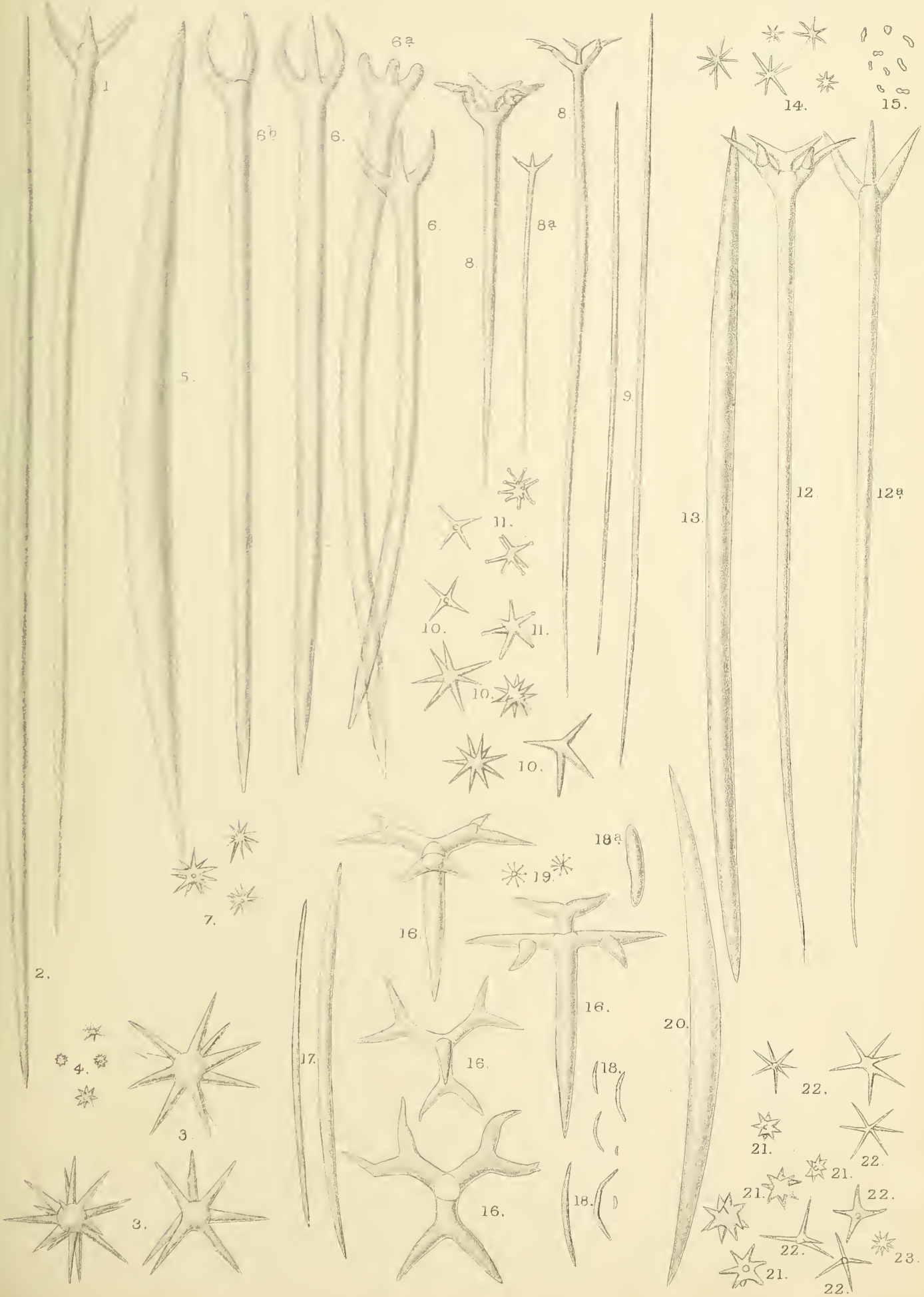
Fig. 12.—Dichotriæne. × 50.
Fig. 12 *a*.—Plagiotriæne. × 50.
Fig. 13.—Oxeote. × 50.
Fig. 14.—Oxyasters. × 440.
Fig. 15.—Microrhabds. × 440.

Figs. 16–19.—*Penares tylotaster*, n. sp. (R. N. XXVII).

Fig. 16.—Dichotriænes (various views). × 66.
Fig. 17.—Oxea. × 66.
Fig. 18.—Microxea. × 66.
Fig. 18 *a*.—Microxeote. × 440.
Fig. 19.—Tylasters. × 440.

Figs. 20–23.—*Jaspis novæ-zealandiæ*, n. sp. (R. N. XXX. 1).

Fig. 20.—Oxeote. × 50.
Fig. 21.—Spherasters. × 475.
Fig. 22.—Oxyasters. × 475.
Fig. 23.—Small spheraster. × 475.


1
2.
3.
3.
4.
5.
6.
6ª
6b
6.
7.
8.
8ª
8.
9.
10.
10.
10.
11.
11.
12.
12ª
13.
14.
15.
16.
16.
16.
16.
17.
18.
18.
18ª
19.
20.
21.
21.
21.
21.
22.
22.
22.
22.
22.
23.

H MUSEUM
Z D
ATURAL H

PLATE VIII.

Figs. 1–7.—*Ancorina alata*, n. sp. (R. N. XXXII. 8).

Fig. 1.—Anatriæne. × 64.
Fig. 2.—Plagiotriæne. × 64.
Fig. 3.—Oxeote. × 64.
Fig. 4.—Style. × 64.
Fig. 5.—Strongylote. × 64.
Fig. 6.—Microrhabds. × 440.
Fig. 7.—Tylasters. × 440.

Figs. 8–15 *b*.—*Ancorina novæ-zealandiæ*, n. sp. (R. N. X).

Fig. 8.—Small oxeote. × 50.
Fig. 9.—Large oxeote × 50.
Fig. 10.—Promesotriæne (Plagiomesotriæne). × 50.
Fig. 10 *a–d*.—Variations of the cladome of the promesotriæne. × 94.
Fig. 11.—Anatriæne. × 50.
Fig. 12.—Plagiotriæne. × 50.
Fig. 13.—Tylasters. × 1085.
Fig. 14.—Tylospherasters. × 1085.
Fig. 15–15 *b*.—Microrhabds. × 1085.

Figs. 16–22.—*Geodia regina*, n. sp. (R. N. XXXII. 3).

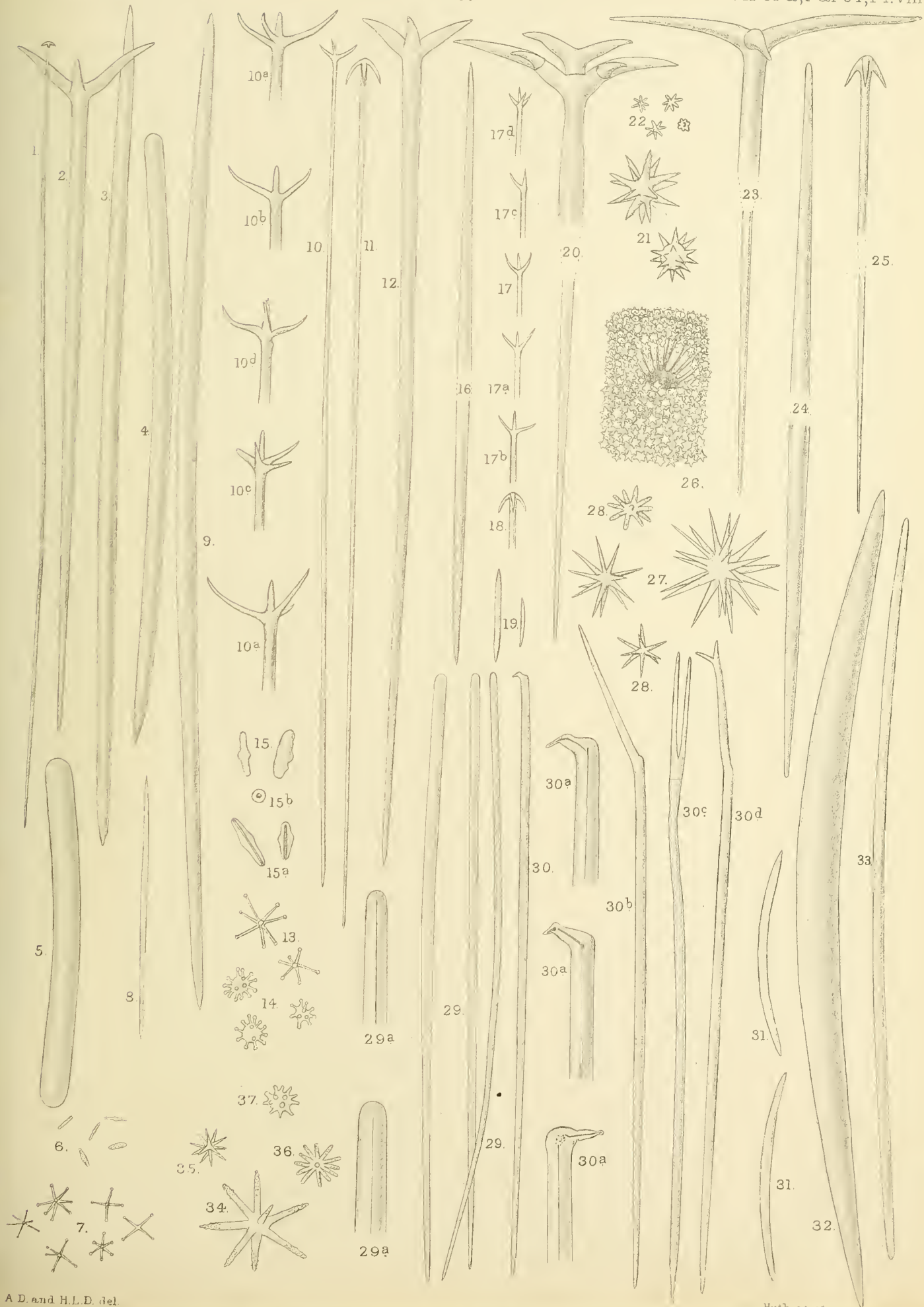
Fig. 16.—Large oxeote. × 50.
Fig. 17.—Cladome of protriæne. × 50.
Fig. 17 *a–d*.—Variations in the cladome of the protriæne. × 50.
Fig. 18.—Cladome of anatriæne. × 50.
Fig. 19.—Cortical oxea. × 50.
Fig. 20.—Dichotriæne. × 50.
Fig. 21.—Oxyspherasters. × 470.
Fig. 22.—Minute spherasters from dermal membrane. × 470.

Figs. 23–28.—*Geodia rex*, n. sp. (R. N. XXXIII. 8).

Fig. 23.—Orthotriæne. × 50.
Fig. 24.—Large oxeote. × 50.
Fig. 25.—Anatriæne. × 50.
Fig. 26.—Portion of sterraster, with hilum. × 275.
Fig. 27.—Larger oxyspherasters. × 1100.
Fig. 28.—Smaller oxyspherasters. × 1100.

Figs. 29–37.—*Geodinella vestigifera*, n. sp. (R. N. L. 8).

Fig. 29.—Styli. × 90.
Fig. 29 *a*.—Bases of styli. × 280.
Fig. 30.—Reduced triæne with vestigial cladus. × 90.
Fig. 30 *a*.—Cladomes of reduced triænes. × 280.
Fig. 30 *b–d*.—Abnormal spicules. × 90.
Fig. 31.—Short oxea. × 90.
Fig. 32.—Stout oxeote. × 90.
Fig. 33.—Slender oxeote × 90.
Fig. 34.—Large oxyaster. × 650.
Fig. 35.—Small oxyaster. × 650.
Fig. 36.—Small strongylaster. × 650.
Fig. 37.—Minute strongylospheraster. × 650.


1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
10a
10b
10c
10d
11.
12.
13.
14.
15.
15b
15a
16.
17.
17a
17b
17c
17d
18.
19.
20.
21.
22.
23.
24.
25.
26.
27.
28.
28.
29.
29a
29.
29a
30.
30a
30b
30c
30d
30a
31.
31.
32.
33.
34.
35.
36.
37.

BRITISH MUSEUM
NATURAL

PLATE IX.

Fig. 1.—*Gellius imperialis*, n. sp. (Partially restored from dry and broken specimen.) R. N. XXXIII 3, 7, 17. × ½.

Fig. 2.—*Amphiastrella kirkpatricki*, n. sp. R. N. LIV. *a*. Nat. size.

Fig. 3.—*Inflatella spherica*, n. sp. R. N. LIV. *b*. Nat. size.

Fig. 4.—*Pyloderma demonstrans*, n. sp. R. N. IX. *a*. Nat. size.

Fig. 5.—*Stelletta crater*, n. sp. R. N. XXXII. 15. × ⅔.

T. F. Collings del. Huth coll.

BRITISH MUSEUM
NATURAL HISTORY

PLATE X.

FIG. 1.—*Clathria scotti*, n. sp. R. N. LII, with *Iophon lævistylus*, n. sp. R. N. LII. *a*, growing on it at *a*. Nat. size.

FIG. 2.—*Isodictya cavicornuta*, n. sp. R. N. XXXIII. 12. *b*. × $\frac{7}{9}$.

FIG. 3.—*Isodictya cavicornuta*, n. sp. R. N. XXXIII. 12. *g*. × $\frac{7}{9}$.

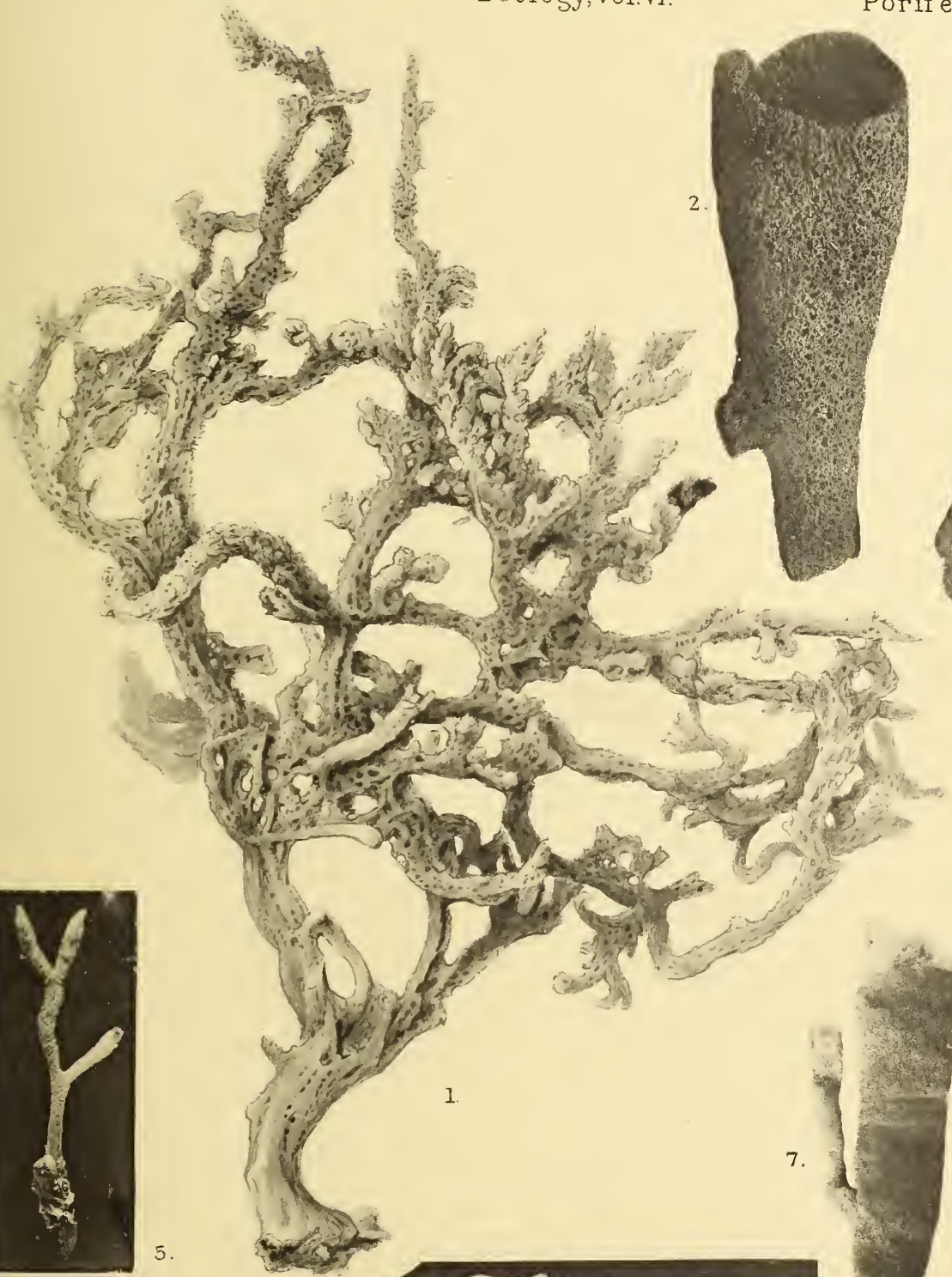
FIG. 4.—*Cinachyra uteoides*, n. sp. R. N. XLII. Nat. size.

FIG. 5.—*Bubaris elegans*, n. sp. R. N. XLI. Nat. size.

FIG. 6.—*Myxilla novæ-zealandiæ*, n. sp. R. N. XVIII. 2. Nat. size.

FIG. 7.—*Siphonochalina latituba*, n. sp. R. N. LVII. *b*. × $\frac{1}{3}$.

FIG. 8.—*Siphonochalina latituba*, n. sp. R. N. III. × $\frac{1}{3}$.



1.

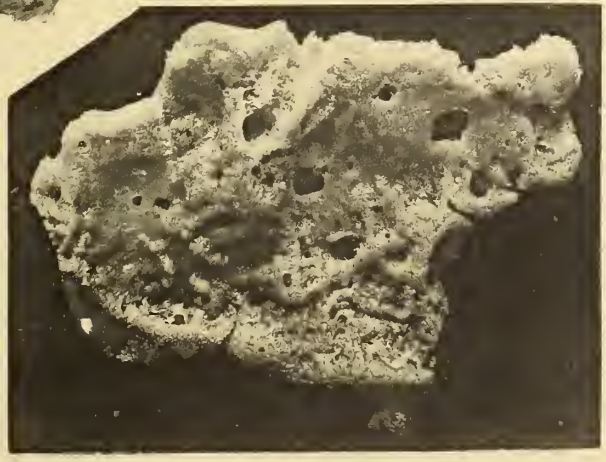
2.

3.

5.

7. 8.

4.



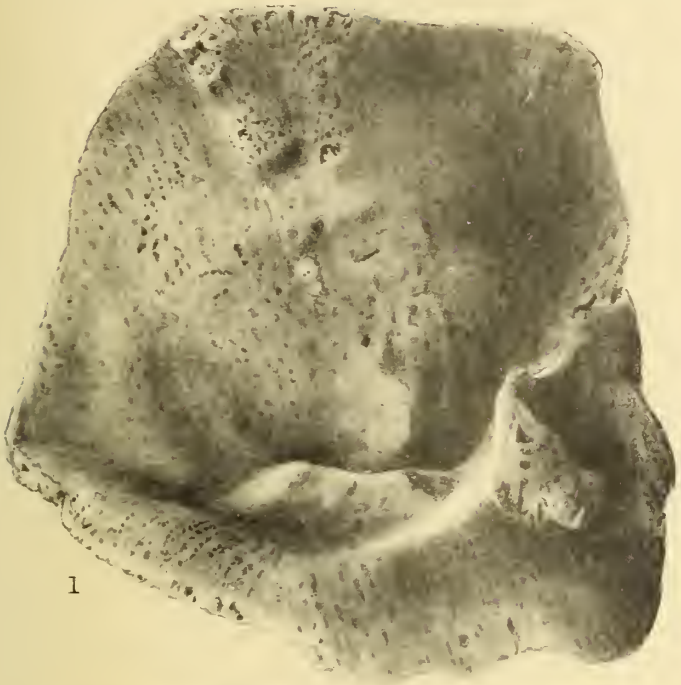
6.

Huth coll.

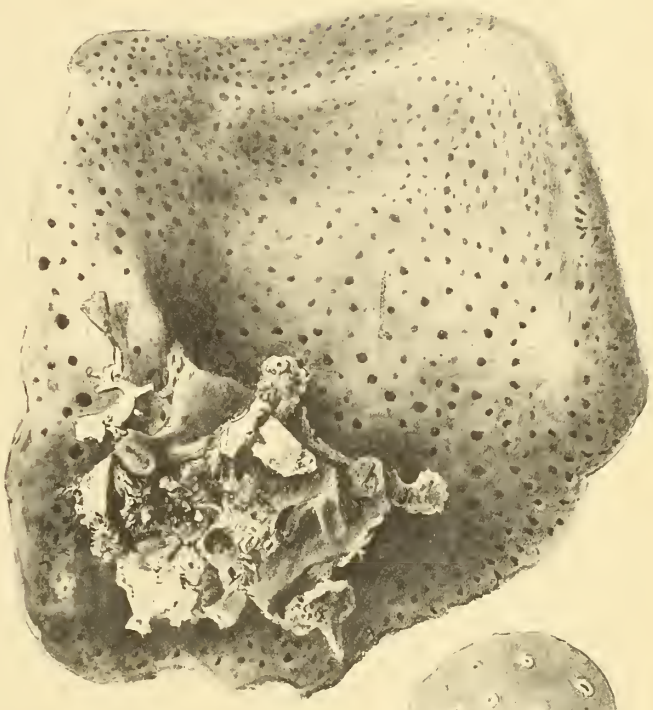
BRITISH MUSEUM
NATURAL
ZOOLOGY

PLATE XI.

FIG. 1.—*Petrosia coralloides*, n. sp. R. N. XXI. Upper surface. Nat. size.
FIG. 1 *a*.—*Petrosia coralloides*, n. sp. R. N. XXI. Lower surface. Nat. size.
FIG. 2.—*Tedaniopsis turbinata*, n. gen. et sp. R. N. XII. × $\frac{3}{4}$.
FIG. 2 *a*.—*Tedaniopsis turbinata*, n. gen. et sp. R. N. XII. Portion of surface. Nat. size.
FIG. 3.—*Tedaniopsis turbinata*, n. gen. et sp., young specimen. R. N. XXVIII. Nat. size.
FIG. 4.—*Parahigginsia phakellioides*, n. gen. et sp. R. N. XVII. Nat. size.



1



1a

2a

2.

3

4.

BRITISH MUSEUM
NATURAL HISTORY

PLATE XII.

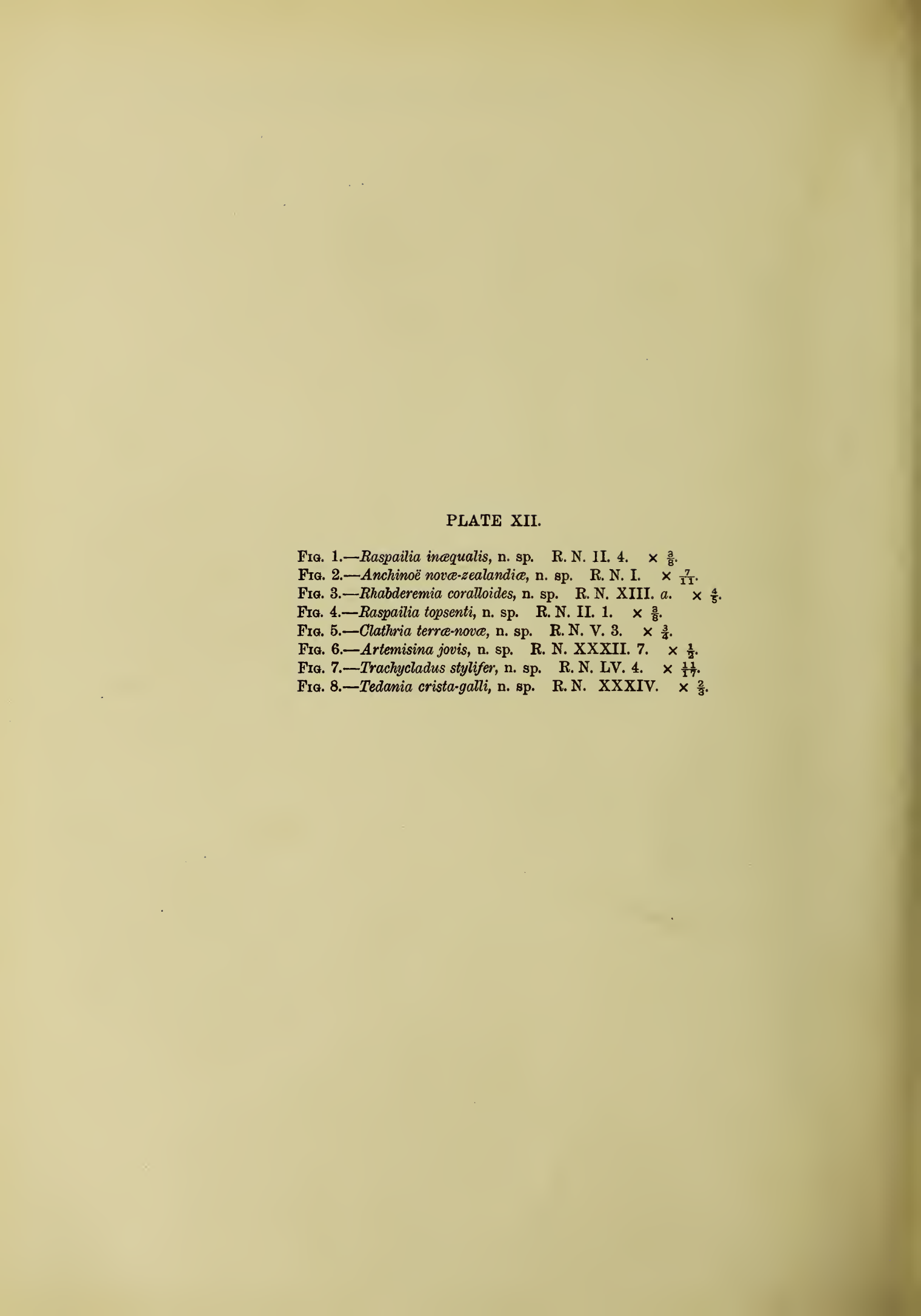
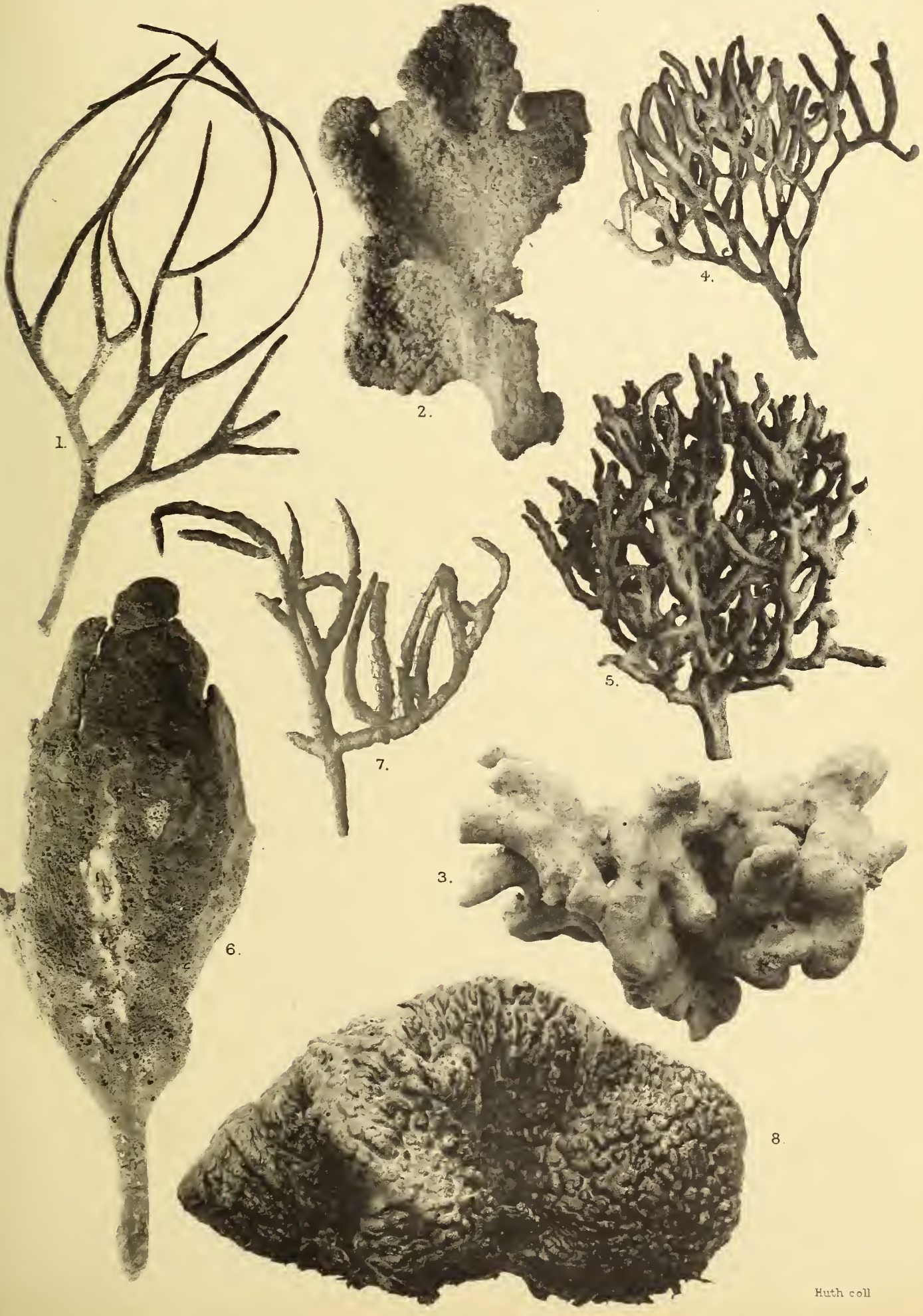


Fig. 1.—*Raspailia inæqualis*, n. sp. R. N. II. 4. × $\frac{3}{8}$.
Fig. 2.—*Anchinoë novæ-zealandiæ*, n. sp. R. N. I. × $\frac{7}{11}$.
Fig. 3.—*Rhabderemia coralloides*, n. sp. R. N. XIII. *a*. × $\frac{4}{5}$.
Fig. 4.—*Raspailia topsenti*, n. sp. R. N. II. 1. × $\frac{3}{8}$.
Fig. 5.—*Clathria terræ-novæ*, n. sp. R. N. V. 3. × $\frac{3}{4}$.
Fig. 6.—*Artemisina jovis*, n. sp. R. N. XXXII. 7. × $\frac{1}{2}$.
Fig. 7.—*Trachycladus stylifer*, n. sp. R. N. LV. 4. × $\frac{11}{17}$.
Fig. 8.—*Tedania crista-galli*, n. sp. R. N. XXXIV. × $\frac{2}{3}$.



Huth coll

BRITISH MUSEUM
NATURAL HISTORY

PLATE XIII.

FIGS. 1–3.—*Lepidospongia incrustans*, n. gen. et sp. (R. N. XXXV. *m*).

FIG. 1.—Outlines of six discotriænes. × 59.
FIG. 2.—Discotriæne. × 210.
FIG. 3.—Microrhabds. × 485.

FIGS. 4–5.—*Oceanapia* (?) *arcifera*, n. sp. (R. N. LV. 3 *a*).

FIG. 4.—Oxeote. × 280.
FIG. 5.—Toxa. × 280.

FIGS. 6–13.—*Mycale novæ-zealandiæ*, n. sp. (R. N. XXIV).

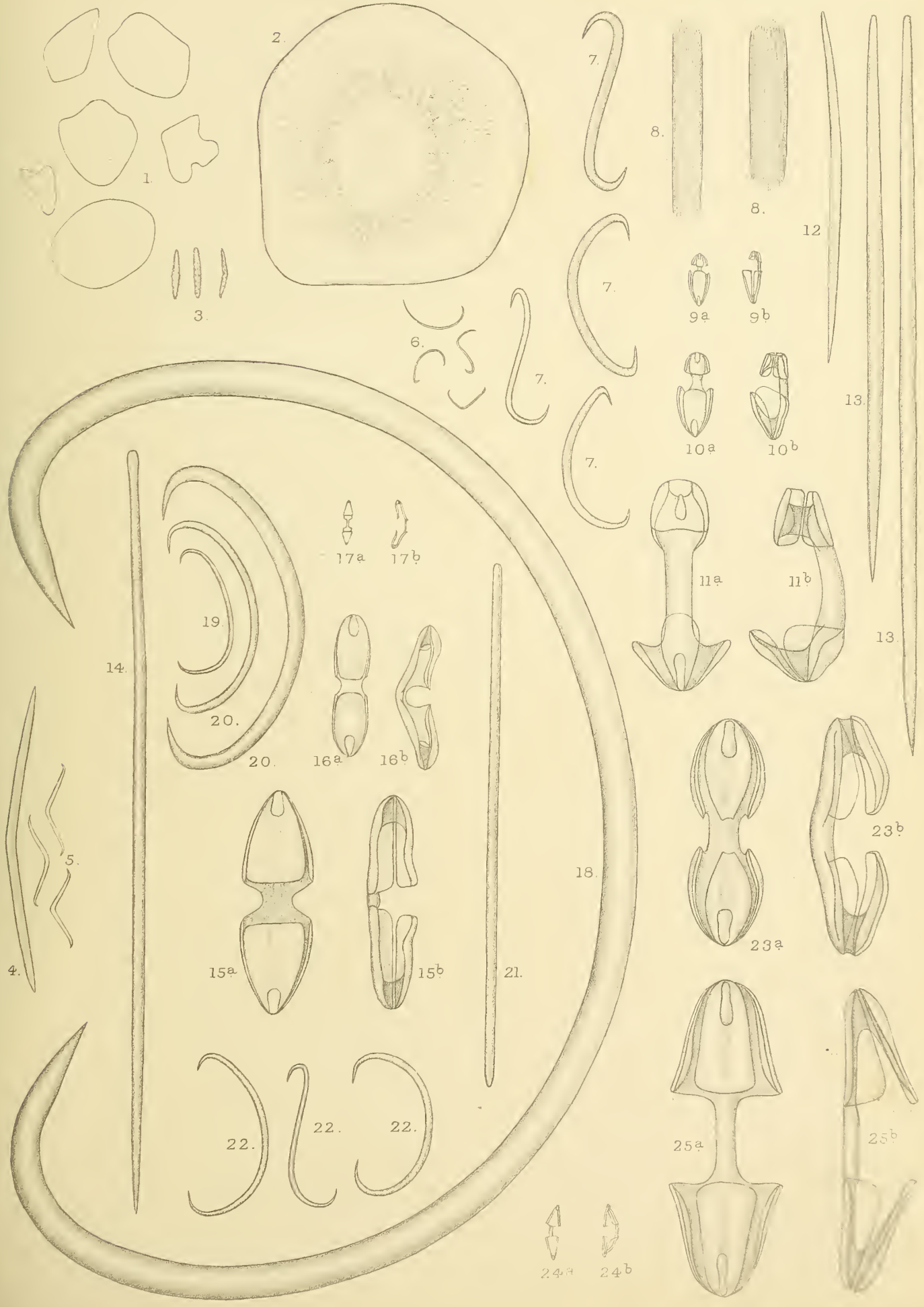
FIG. 6.—Small sigmata. × 485.
FIG. 7.—Large sigmata. × 485.
FIG. 8.—Trichodragmata. × 485.
FIG. 9 *a*.—Small palmate anisochela, front view. × 485.
FIG. 9 *b*.—Small palmate anisochela, side view. × 485.
FIG. 10 *a*.—Intermediate palmate anisochela, front view. × 485.
FIG. 10 *b*.—Intermediate palmate anisochela, side view. × 485.
FIG. 11 *a*.—Large palmate anisochela, front view. × 485.
FIG. 11 *b*.—Large palmate anisochela, side view. × 485.
FIG. 12.—Short style. × 123.
FIG. 13.—Long styli. × 123.

FIGS. 14–20.—*Esperiopsis macrosigma* Stephens, var. *novæ-zealandiæ*, nov. (R. N. XXXV. *j*).

FIG. 14.—Subtylostyle. × 330.
FIG. 15 *a*.—Large palmate isochela, front view. × 550.
FIG. 15 *b*.—Large palmate isochela, side view. × 550.
FIG. 16 *a*.—Intermediate palmate isochela, front view. × 550.
FIG. 16 *b*.—Intermediate palmate isochela, side view. × 550.
FIG. 17 *a*.—Small palmate isochela, front view. × 550.
FIG. 17 *b*.—Small palmate isochela, side view. × 550.
FIG. 18.—Giant sigma. × 550.
FIG. 19.—Small sigma. × 550.
FIG. 20.—Intermediate sigmata. × 550.

FIGS. 21–25.—*Esperiopsis megachela*, n. sp. (R. N. XXXV. *b*).

FIG. 21.—Style. × 122.
FIG. 22.—Sigmata. × 485.
FIG. 23 *a*.—Intermediate palmate isochela, front view. × 485.
FIG. 23 *b*.—Intermediate palmate isochela, side view. × 485.
FIG. 24 *a*.—Small palmate isochela, front view. × 485.
FIG. 24 *b*.—Small palmate isochela, side view. × 485.
FIG. 25 *a*.—Large palmate isochela, front view. × 485.
FIG. 25 *b*.—Large palmate isochela, side view. × 485.


1.
2.
3.
4.
5.
6.
7.
7.
7.
7.
8.
8.
9a
9b
10a
10b
11a
11b
12
13.
13
14.
15a
15b
16a
16b
17a
17b
18.
19.
20.
20.
21.
22.
22.
22.
23a
23b
24a
24b
25a
25b

BRITISH MUSEUM
NATURAL HISTORY

PLATE XIV.

Figs. 1–4.—*Biemna novæ-zealandiæ*, n. sp. (R. N. XXXIII. 1 *a*).

Fig. 1.—Style. × 122.
Fig. 2.—Large sigma. × 470.
Fig. 3.—Microxeote. × 470.
Fig. 4.—Small sigma. × 470.

Figs. 5–8.—*Clathria scotti*, n. sp. (R. N. LII).

Fig. 5.—Large style. × 170.
Fig. 6.—Tylostyle. × 170.
Fig. 7.—Acanthostyles. × 170.
Fig. 8.—Toxa. × 280.

Figs. 9–13.—*Clathria terræ-novæ*, n. sp. (R. N. V).

Fig. 9.—Large acanthostyles. × 170.
Fig. 10.—Small acanthostyles. × 170.
Fig. 10 *a*.—Intermediate acanthostyle. × 170.
Fig. 11.—Slender tylostyle. × 170.
Fig. 12.—Toxon. × 280.
Fig. 13.—Isochela. × 280.

Figs. 14–16.—*Raspailia topsenti*, n. sp. (R. N. II. 1).

Fig. 14.—Stout styli. × 240.
Fig. 15.—Slender styli or rhaphides of dermal brushes. × 240.
Fig. 16.—Acanthosubtylostyli. × 240.

Figs. 17–19.—*Raspailia inæqualis*, n. sp. (R. N. II. 4).

Fig. 17.—Stout stylus. × 240.
Fig. 18.—Slender styli. × 240.
Fig. 19.—Acanthostyle. × 240.

Figs. 20–21.—*Bubaris oxeata*, n. sp. (R. N. XXXV. *f*).

Fig. 20.—Styli. × 170.
Fig. 21.—Oxea. × 170.

Figs. 22–24.—*Bubaris elegans*, n. sp. (R. N. XLI).

Fig. 22.—Long stylus. × 170.
Fig. 23.—Short stylus. × 170.
Fig. 24.—Oxea. × 170.

Figs. 25–27.—*Bubaris ornata*, n. sp. (R. N. XXXV. *o*).

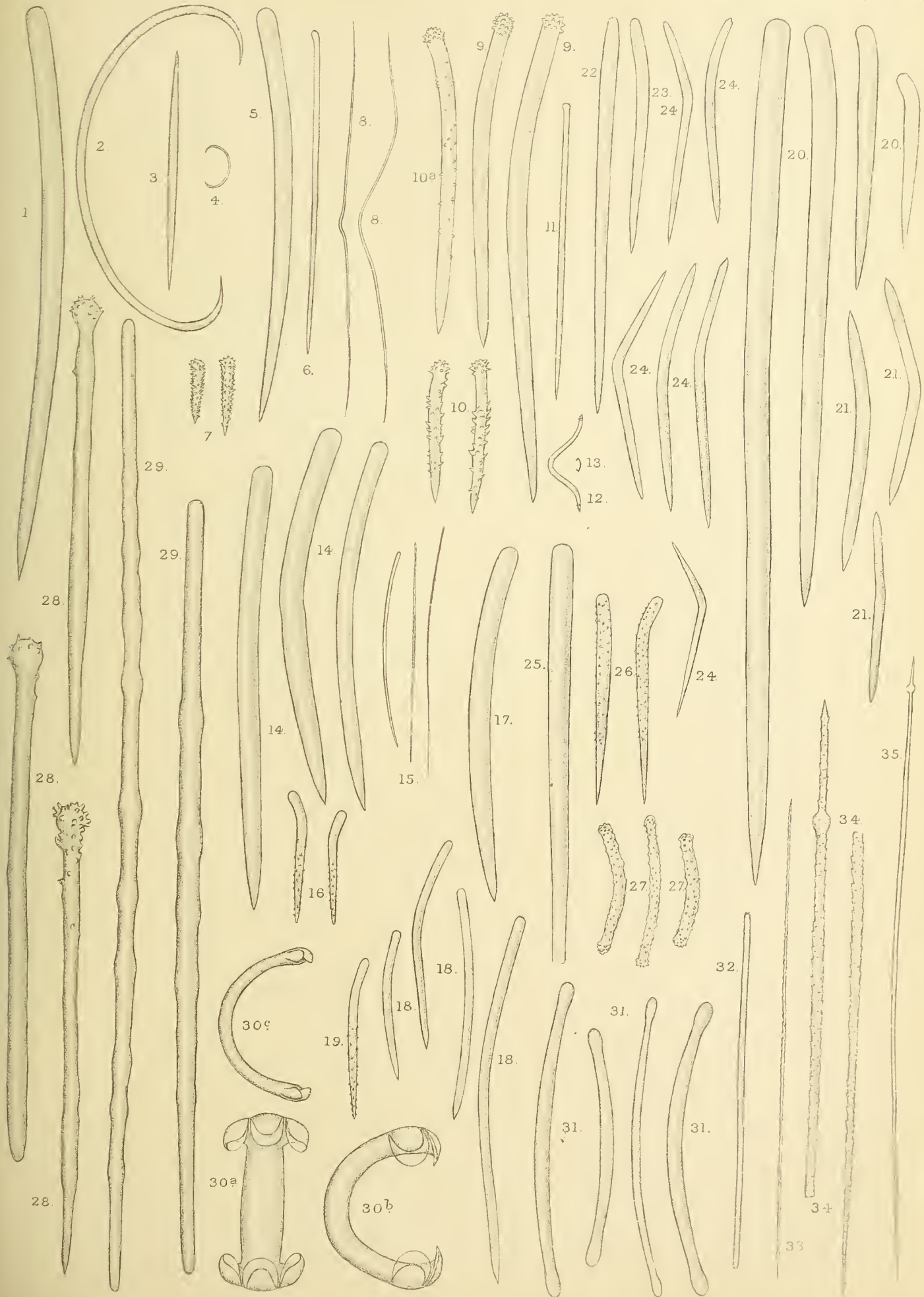
Fig. 25.—Part of long style. × 280.
Fig. 26.—Acanthostyles. × 280.
Fig. 27.—Acanthostrongyla. × 280.

Figs. 28–30 *c*.—*Hymedesmia lundbecki*, n. sp. (R. N. XXXV. *c*).

Fig. 28.—Acanthotylostyles. × 330.
Fig. 29.—Strongyla. × 330.
Fig. 30 *a*.—Tridentate isochela, front view. × 550.
Fig. 30 *b*.—Tridentate isochela, side view. × 550.
Fig. 30 *c*.—Tridentate isochela, side view (young). × 550.

Figs. 31–35.—*Tedaniopsis turbinata*, n. gen. et sp. (R. N. XII).

Fig. 31.—Tylota. × 120.
Fig. 32.—Slender diact. × 210.
Fig. 33.—Smaller rhaphis. × 485.
Fig. 34.—The two terminal portions of a tylorhaphis. × 485.
Fig. 35.—Tylorhaphis. × 210.



A D and H L D del

FIELD MUSEUM
ZOOLOGY
NATURAL HISTORY

PLATE XV.

Figs. 1–4.—*Rhabderemia coralloides*, n. sp. (R. N. XIII).

Fig. 1.—Acanthostyle. × 170.
Fig. 1 *a*.—Acanthostyle (young). × 170.
Fig. 2.—Microstyle. × 485.
Fig. 3.—Contort sigmata. × 485.
Fig. 4.—Microxeote. × 485.

Figs. 5–8.—*Anchinoë fristedti*, n. sp. (R. N. XIX. 7).

Fig. 5.—Large acanthostyle. × 280.
Fig. 6.—Small acanthostyle. × 280.
Fig. 7.—Tornota (subtylota). × 280.
Fig. 8.—Isochela. × 630.

Figs. 9–11.—*Anchinoë novæ-zealandiæ*, n. sp. (R. N. I).

Fig. 9.—Tornote. × 280.
Fig. 10.—Acanthostyles. × 280.
Fig. 11.—Isochela. × 630.

Figs. 12–15 *b*.—*Myxilla novæ-zealandiæ*, n. sp. (R. N. XVIII. 2).

Fig. 12.—Style. × 170.
Fig. 13.—Strongylote. × 170.
Fig. 13 *a*.—Ends of 13. × 660.
Fig. 14.—Large isochela (isancora spatulifera). × 1070.
Fig. 15 *a*.—Small isochela, front view. × 1070.
Fig. 15 *b*.—Small isochela, side view. × 1070.

Figs. 16–21.—*Crellomyxilla intermedia*, n. gen. et sp. (R. N. LV. 5).

Fig. 16.—Large acanthostyle from main skeleton. × 280.
Fig. 17.—Tornotoxeote. × 280.
Fig. 18.—Small dermal acanthostyle. × 280.
Fig. 19.—Large isochela. × 1070.
Fig. 20.—Small isochela. × 1070.
Fig. 21.—Sigma. × 1070.

Figs. 22–23 *b*.—*Pyloderma demonstrans*, n. sp. (R. N. IX. *b*).

Fig. 22.—Oxeote. × 215.
Fig. 23 *a*.—Isochela, front view. × 1100.
Fig. 23 *b*.—Isochela, side view. × 1100.

Figs. 24–27—*Histodermella australis*, n. sp. (R. N. L. 1. *d*).

Fig. 24.—Tylota. × 120.
Fig. 25.—Strongylote. × 120.
Fig. 26.—Acanthoxeote. × 210.
Fig. 27.—Acanthostyle. × 210.

Figs. 28–31.—*Amphiastrella kirkpatricki*, n. sp. (R. N. LIV).

Fig. 28.—Tylote. × 122.
Fig. 29.—Strongylote. × 122.
Fig. 30.—Birotulate isochela. × 1080.
Fig. 31.—Birotulate isochela (end view). × 1080.

Figs. 32–33.—*Parahigginsia phakellioides*, n. gen. et sp. (R. N. XVII).

Fig. 32.—Oxeote. × 210.
Fig. 33.—Acanthomicroxea. × 430.

Figs. 34–38.—*Discorhabdella incrustans*, n. gen. et sp. (R. N. XLVI. 3).

Fig. 34.—Large acanthosubtylostyle. × 122.
Fig. 34 *a–c*.—Bases of large acanthosubtylostyles. × 122.
Fig. 35.—Pseudastrose acanthotylostyles. × 485.
Fig. 35 *a*.—Pseudastrose acanthotylostyle. (young). × 485.
Fig. 36.—Slender tylostyle. × 122.
Fig. 37.—Isochela. × 485.
Fig. 37 *a*.—Isochela (end view). × 485.
Fig. 38.—Oxydiscorhabds. × 485.

Figs. 39–42.—*Trachycladus stylifer*, n. sp. (R. N. LV. 4).

Fig. 39.—Strongylote. × 170.
Fig. 40.—Styli. × 170.
Fig 41.—Spinispiræ. × 900.
Fig. 42.—Microrhabds. × 900.

Figs. 43–45.—*Dotonella mirabilis*, n. gen. et sp. (R. N. XXXV. *d*).

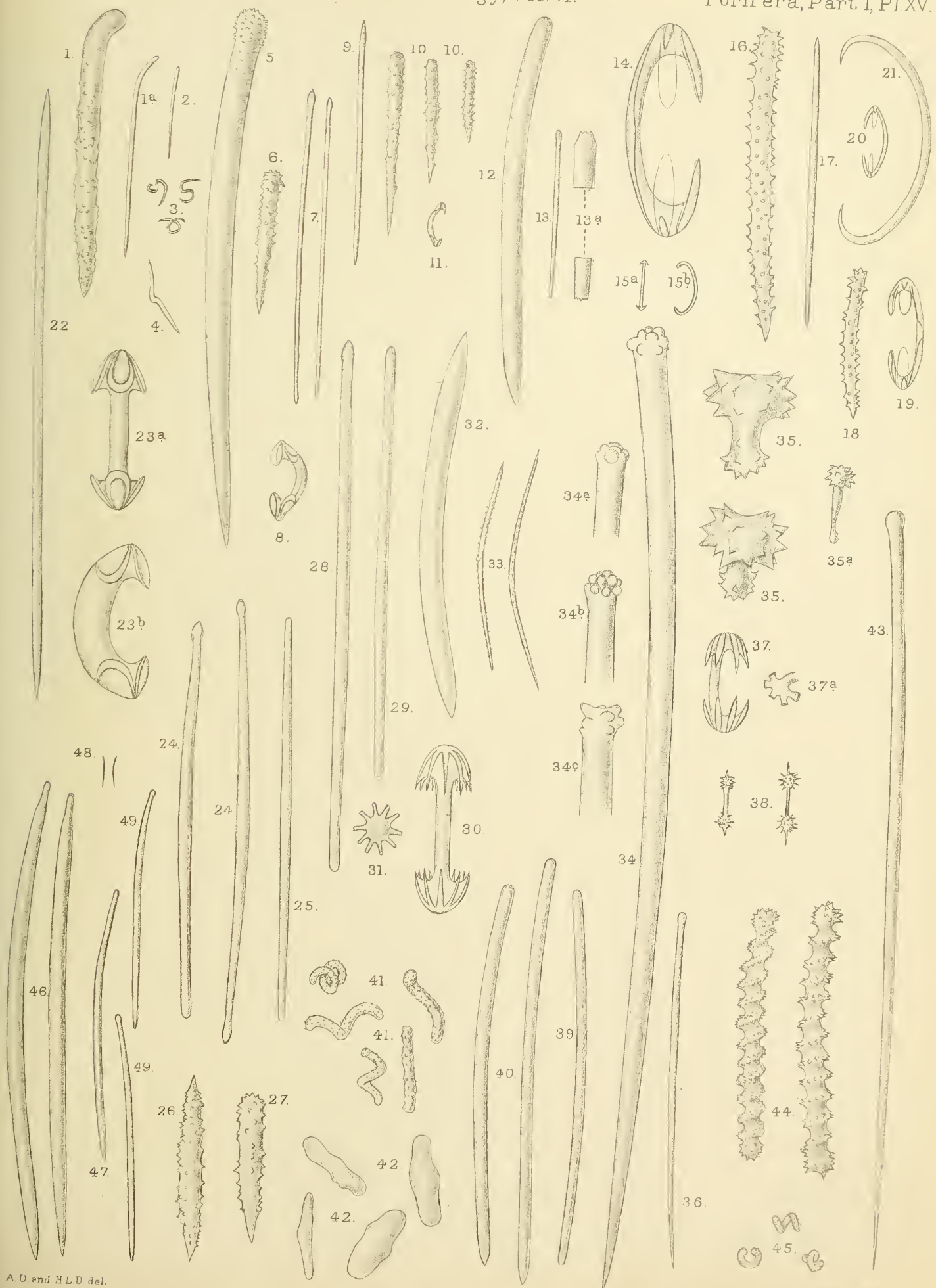
Fig. 43.—Tylostyle. × 120.
Fig. 44.—Large spinispiræ. × 485.
Fig. 45.—Small spinispiræ. × 485.

Figs. 46–49.—*Microtylostylifer anomalus*, n. gen. et sp. (R. N. XLVII. 7).

Fig. 46.—Styli. × 130.
Fig. 47.—Young (?) style. × 130.
Fig. 48.—Microtylostyles. × 130.
Fig. 49.—Microtylostyles. × 820.

Brit. Antarctic (Terra Nova) Exped. 1910.

Brit. Mus. (Nat. Hist.) Zoology, Vol. VI. Porifera, Part I, Pl. XV.



A. D. and H. L. D. del.

BRITISH MUSEUM
NATURAL HISTORY

B.7.4

BRITISH MUSEUM (NATURAL HISTORY).

BRITISH ANTARCTIC ("TERRA NOVA") EXPEDITION, 1910

NATURAL HISTORY REPORT.

ZOOLOGY. Vol. VI. No. 4. Pp. 393–458.

PORIFERA.

PART II.—ANTARCTIC SPONGES.

BY

MAURICE BURTON M.Sc.

(*Assistant-Keeper in the Department of Zoology, British Museum (Natural History)*).

WITH NINE TEXT FIGURES AND FIVE PLATES.

B. M.
(N.H.)

LONDON:
PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM
SOLD BY
B. Quaritch, Ltd., 11 Grafton Street, New Bond Street, W.1; Dulau & Co., Ltd., 32 Old Bond Street, London, W.1; Oxford University Press, Warwick Square, London, E.C.4
Wheldon & Wesley, Ltd., 2, 3 and 4 Arthur Street, New Oxford Street, W.C.2
Oliver & Boyd, Tweeddale Court, Edinburgh
AND AT
The British Museum (Natural History), Cromwell Road, S.W.7
1929

[*All rights reserved*]

Price Ten Shillings.

Issued 27th April, 1929]

British Museum (Natural History).

This is No. 3 *of* 25 *copies of "Terra Nova" Zoology, Vol. VI., Porifera, Part II., Antarctic Sponges, printed on Special paper.*

27 MAY 1929
PRESENTED

BRITISH MUSEUM
Z D
NATURAL HISTORY

PORIFERA.

PART II.—ANTARCTIC SPONGES.

BY MAURICE BURTON, M.Sc.

(*Assistant-Keeper in the Department of Zoology, British Museum (Natural History)*).

WITH NINE TEXT FIGURES AND FIVE PLATES.

PAGE

I. Introduction 393
II. Geographical distribution 393
III. List of Antarctic species 394
IV. Systematic notes and description of species 401
V. List of works referred to 449
VI. Index 453

I.—INTRODUCTION.

The sponge-fauna of the Antarctic has been so well explored by the "Belgica," "Discovery," "Scotia," "Gauss," and "Charcot" expeditions that it is not surprising that the collection of the "Terra Nova" Expedition has added only eleven new species to the total. The collection is so rich, however, that, in conjunction with the older collections now in the British Museum, it has afforded material for a revision of all the described species. The Museum is indebted to the Berlin Museum authorities and to Professor E. Topsent for specimens of species obtained by the "Gauss," "Belgica," etc.

II.—GEOGRAPHICAL DISTRIBUTION.

For the purposes of this report the Antarctic is taken as defined by Regan in his report on the Fishes (Vol. I, 1914). The distribution of the sponges within the area follows very closely that of the fishes, with three well-marked areas around the Magellan Straits, Kerguelen, and the southern islands of New Zealand respectively, where the sponge-

fauna, while resembling to some extent that of the rest of the Antarctic, possesses marked peculiarities of its own.

The Antarctic sponge-fauna contains upwards of 230 species and varieties, including those now described as new, of which some 270 are peculiar to the region, the remainder being species common to the waters adjacent to the Antarctic.

The characteristic features of the fauna are :—(i) The paucity of the Euceratosa and the Pseudoceratosa (*i.e.* the Chalininæ) and the comparative rarity of the spongin-forming sponges in the other groups ; (ii) The rarity of the species of Astrosclerophora which, with two exceptions, have migrated in from New Zealand ; (iii) The richness of the Hexactinellida, particularly of those belonging to the family Rossellidæ ; (iv) The fact that while such groups of the Sigmatosclerophora as the Tetillidæ, Esperellinæ, and Cœlospheræ are abundantly represented, the Ectyoninæ, so rich in species in other parts of the world, are here comparatively few.

The fauna of the Antarctic has much in common with that of the Arctic. In addition to the few species common to both regions, we find that, for the most part, the same genera are present in both areas although the species representing them are not always closely related.

III.—LIST OF ANTARCTIC SPECIES.

	Marion Is.	Kerguelen.	South Georgia.	South Orkneys.	Graham Land.	Victoria Land.	Wilhelm Land.	Coats Land.	Extra-Antarctic Distribution.
CALCAREA.									
Leucosolenia botryoides (Ellis and Solander)		×			×	×			N. Atlantic : Australia.
coriacea (Montagu)					×	×			Almost cosmopolitan.
Leucetta primigenia, Haeckel ..		×				×	×		
microrhaphis (Haeckel) ..					×				
†*leptoraphis* (Jenkin)						×			
Leucettusa vera, Poléjaeff		×							
†*lancifer*, Dendy..						×			New Zealand.
Sycon antarcticum (Jenkin) ..						×			
australe (Jenkin)						×			
longstaffi (Jenkin)						×			
Grantia hirsuta (Topsent)		×			×	×			
chartacea (Jenkin)						×			
aculeata, Urban		×							
Achromorpha glacialis, Jenkin ..						×			
grandinis, Jenkin						×			
nivalis, Jenkin						×			
†*truncata* (Topsent)					×				

Species marked (†) are those represented in the "Terra Nova" collections.

LIST OF ANTARCTIC SPECIES—*continued.*

	Marion Is.	Kerguelen.	South Georgia.	South Orkneys.	Graham Land.	Victoria Land.	Wilhelm Land.	Coats Land.	Extra-Antarctic Distribution.
†*Megapogon villosus*, Jenkin ..									
Leuconia ovata, Poléjaeff		×							
†*levis*, Poléjaeff		×				×			
frigida, Jenkin						×	×		
hiberna, Jenkin						×			
cirrhosa, Urban..		×							
kerguelensis, Urban		×							
minor, Urban		×							
anfracta, Urban		×							
joubini (Topsent)					×	×			
Amphoriscus elongatus, Poléjaeff ..		×							
HEXACTINELLIDA.									
EUPLECTELLIDÆ.									
Holascus fibulatus, Schulze ..		×							Tasmania.
Malacosaccus vastus, Schulze ..		×							
pedunculatus, Topsent ..								×	
coatsi, Topsent								×	
Acœlocalyx, Topsent									
brucei, Topsent..				×					
Docosaccus ancoratus, Topsent ..				×					
CAULOPHACIDÆ.									
Caulophacus latus, Schulze ..		×							
antarcticus, Schulze and Kirkpatrick							×		
instabilis, Topsent			×						
scotiæ, Topsent..								×	
ROSSELLIDÆ.									
Rossella antarctica, Carter, †subsp. *antarctica*, Schulze and Kirkpatrick					×	×	×		
antarctica, subsp. *solida*, Kirkpatrick		×							
†*racovitzæ*, Topsent				×	×	×	×		
†*nuda*, Topsent					×	×	×		
†*villosa* sp. n.						×			
Gymnorossella inermis, Topsent ..					×				
Bathydorus spinosus, Schulze ..					×				
levis var. *ciliatus*, Topsent ..								×	
Calycosoma validum, Schulze ..				×					N. Atlantic.
†*Anoxycalyx ijimai*, Kirkpatrick					×	×	×		
†*Scolymastra joubini*, Topsent ..					×				
Acanthascus grossularia, Schulze		×							
HYALONEMATIDÆ.									
Hyalonema drygalskii, Schulze and Kirkpatrick							×		

LIST OF ANTARCTIC SPECIES—*continued.*

	Marion Is.	Kerguelen.	South Georgia.	South Orkneys.	Graham Land.	Victoria Land.	Wilhelm Land.	Coats Land.	Extra-Antarctic Distribution.
COSCINOSPORIDÆ.									
Chonelasma lamella, Schulze ..		×							
lamella choanoides, Schulze and Kirkpatrick							×		
FARREIDÆ.									
Farrea occa, Bowerbank					×				Almost cosmopolitan.
Eurete gerlachei, Topsent					×				
DACTYLOCALYCIDÆ.									
Aulocalyx irregularis, Schulze ..							×		Bermudas, S. Africa,
Stylocalyx claviger, Schulze ..		×							[Crozet Is.
MYXOSPONGIDA.									
Oscarella lobularis (Schmidt) ..					×				Atlantic Ocean.
†*Halisarca dujardini* (Johnston), var. *magellanica*, Topsent ..						×			Londonderry Is., S. [America.
TETRAXONIDA.									
HOMOSCLEROPHORA.									
PLAKINIDÆ.									
Plakina monolopha, Schulze ..							×		Northern Hemisphere.
trilopha, Schulze							×		North Atlantic.
ASTROSCLEROPHORA.									
STELLETTIDÆ.									
†*Stelletta purpurea*, Ridley ..						×			Indian Ocean, Indo-Pacific Australia, N.Z.
†*maori*, Dendy						×			New Zealand.
†*crater*, Dendy						×			New Zealand.
†*Jaspis novæ-zealandiæ*, Dendy ..						×			New Zealand.
†*Penares tylotaster*, Dendy ..						×			New Zealand.
Monosyringa longispinum (Lendenfeld)							×		
†*bronstedi*, sp. n...						×			
GEODIIDÆ.									
†*Geodinella vestigifera*, Dendy ..						×			New Zealand.
STREPTASTROSCLEROPHORA.									
THENEIDÆ.									
Thenea delicata, Sollas		×							
Pœcillastra schulzii, Sollas ..		×							
SIGMATOSCLEROPHORA.									
TETILLIDÆ.									
Tetilla coronida, Sollas.		×							
†*leptoderma*, Sollas		×				×			South America.
†*metaclada* (Lendenfeld) ..						×			South Africa.
†*Cinachyra antarctica* (Carter) ..					×	×	×		
antarctica, var. *monticularis*, Kirkpatrick						×			
†*barbata*, Sollas		×			×	×	×		
coactifera (Lendenfeld) ..		×							

LIST OF ANTARCTIC SPECIES—*continued.*

	Marion Is.	Kerguelen.	South Georgia.	South Orkneys.	Graham Land.	Victoria Land.	Wilhelm Land.	Coats Land.	Extra-Antarctic Distribution.
HAPLOSCLERIDÆ.									
†*Chalina topsenti* (Thiele) ..		×				×			South America.
†*altera* (Topsent)					×	×			
†*penicillata* (Topsent)					×	×			
†*virens* (Topsent)					×	×			
dancoi (Topsent)					×	×	×		
spongiosissima (Topsent) ..					×				
†*Cladochalina dendyi*, sp. n. ..						×			Australia, Indian Ocean, New Zealand.
Siphonochalina gaussiana, Hentschel							×		
†*Calyx stipitatus*, Topsent ..					×				
Halichondria panicea (Pallas) ..							×		Atlantic and Northern Hemisphere generally.
†*variabilis* (Ridley)					×				Southern Hemisphere [generally.
similis (Ridley and Dendy) ..		×							
Gellius glacialis var. *nivea*, Ridley and Dendy		×				×	×		
carduus, Ridley and Dendy ..		×							
flagellifer, Ridley and Dendy		×							Almost cosmopolitan.
†*rudis*, Topsent					×	×	×		
†*bidens*, Topsent..					×	×	×		
cucurbitiformis, Kirkpatrick ..						×	×		
phakellioides, Kirkpatrick ..						×	×		
pilosa, Kirkpatrick							×		
†*benedeni*, Topsent					×	×	×		
arcuarius, Topsent				×					
†*Gelliodes spongiosus*, Topsent ..					×	×			
kerguelensis, Hentschel ..		×							
†*Microxina charcoti*, Topsent ..					×	×			
DESMACIDONIDÆ.									
Isodictya setifer, Topsent					×	×	×		
kerguelensis (Ridley and Dendy)		×							
antarctica (Kirkpatrick) ..						×			
†*cactoides* (Kirkpatrick) ..						×			
†*spinigera* (Kirkpatrick) ..						×			
†*verrucosa* (Topsent)						×			Burdwood Bank.
trigona (Topsent)			×		×				
erinacea (Topsent)					×				
†*kirkpatricki* (Topsent)			×			×			
†*cavicornuta*, Dendy					×				New Zealand.
obliquidens (Hentschel) ..							×		
kerguelensis var. *simillima* (Hentschel)							×		
doryphora (Brøndsted).. ..						×			

LIST OF ANTARCTIC SPECIES—*continued.*

	Marion Is.	Kerguelen.	South Georgia.	South Orkneys.	Graham Land.	Victoria Land.	Wilhelm Land.	Coats Land.	Extra-Antarctic Distribution.
†*Desmacidon fruticosa* (Montagu)						×			Europe, S. Africa (Burton MSS.), Australia.
†*Plumocolumella meandrina* (Kirkpatrick)						×			
†*cribriporosa*, sp. n.						×			
†*Cercidochela lankesteri*, Kirkpatrick						×	×		
Guitarra fimbriata, Carter ..					×		×		Almost cosmopolitan.
Hoplokithara dendyi, Kirkpatrick						×	×		
MYCALEÆ.									
Esperiopsis villosa (Carter) ..						×			Atlantic, New Zealand.
Amphilectus edwardii (Bowerbank)							×		Atlantic, S. Africa, New Zealand.
†*rugosa* var. *major* (Hentschel)							×		
scotiæ (Topsent)								×	
Mycale magellanica (Ridley) ..						×			Burdwood Bank, S. America.
†*acerata*, Kirkpatrick					×	×	×		
acerata var. *sphærulosa*, Hentschel							×		
†*pellita*, Topsent..						×			Burdwood Bank.
†*tridens*, Hentschel					×	×	×		
antarctica, Hentschel							×		
rossi, Hentschel							×		
gaussiana, Hentschel							×		
Biemna macrorhaphis, Hentschel..							×		
†*Desmacella vestibularis* (Wilson)..						×			S. Pacific, S. Africa, New Zealand.
Artemisina apollinis (Ridley and Dendy)		×			×	×	×		N. Atlantic.
plumosa, Hentschel							×		
Asbestopluma belgicæ, Topsent ..					×				
callithrix, Hentschel							×		
calyx, Hentschel							×		
†*Chondrocladia clavata*, Ridley and Dendy						×			Fiji Is.
antarctica, Hentschel							×		
Phelloderma radiatum, Ridley and Dendy							×		S. America.
†*Acanthorhabdus fragilis*, sp. n. ..						×			
†*Chondropsis chaliniformis* (Carter)						×			Australia.
CLATHRIÆ.									
†*Axociella nidificata* (Kirkpatrick)						×			
†*flabellata* (Topsent)					×	×			
Clathria pauper, Brøndsted ..						×			
Raspailia irregularis, Hentschel ..							×		
†*Pseudanchinoë toxiferum* (Topsent)					×	×			Gough Is.

LIST OF ANTARCTIC SPECIES—*continued.*

	Marion Is.	Korguelen.	South Georgia.	South Orkneys.	Graham Land.	Victoria Land.	Wilhelm Land.	Coats Land.	Extra-Antarctic Distribution.
HYMEDESMIEÆ.									
Hymedesmia exigua, Kirkpatrick..						×			
rufa (Kirkpatrick)					×	×			
areolata, Thiele						×			Chile.
simillina var. *antarctica*, Hentschel							×		
dermata var. *antarctica*, Hentschel							×		
leptochela, Hentschel							×		
gaussiana, Hentschel							×		
fristedti (Topsent)					×				
†*unguifera*, sp. n.						×			
†*Rhabderemia coralloides*, Dendy..						×			New Zealand.
†*Plocamia gaussiana*, Hentschel ..						×	×		
Myxilla incrustans (Johnston) ..						×			
spongiosa (Ridley and Dendy)						×			Patagonia.
spongiosa var. *asigmata*, Topsent					×	×	×		
australis (Topsent)					×				
†*elongata*, Topsent					×	×			
magna, Topsent					×				
pistillaris, Topsent					×				
Lissodendoryx decepta, Kirkpatrick						×			
styloderma, Hentschel							×		
antarctica, Hentschel							×		
†*flabellata*, sp. n...						×			
†*innomata*, sp. n.						×			
Ectyomyxilla mariana, Ridley and Dendy		×							
mariana var. *tylacantha*, Hentschel							×		
†*kerguelensis*, Hentschel ..		×				×			New Zealand.
hentscheli, sp. n.							×		
Ectyodoryx nobilis, Ridley and Dendy									
nobilis var. *plumosa*, Hentschel							×		
frondosa, Ridley and Dendy ..									
frondosa var. *anacantha*, Hentschel							×		
ramilobosa (Topsent)					×	×			
Myxodoryx hanitschi (Kirkpatrick)					×	×	×		
†*Anchinoë latrunculioides* (Ridley and Dendy)					×	×	×		S. America, S. Africa.
Kirkpatrickia variolosa (Kirkpatrick)						×			
coulmani (Kirkpatrick) ..						×			

LIST OF ANTARCTIC SPECIES—*continued.*

	Marion Is	Kerguelen.	South Georgia.	South Orkneys.	Graham Land.	Victoria Land.	Wilhelm Land.	Coats Land.	Extra-Antarctic Distribution.
†*Inflatella belli* (Kirkpatrick) ..						×	×		New Zealand.
CRELLEÆ.									
Crella crassa (Hentschel)							×		
stylifera, Hentschel							×		
Crellina tubifex, Hentschel ..							×		
Acanthoxa werthi, Hentschel ..							×		
TEDANIEÆ.									
Tedania charcoti, Topsent ..						×			Burdwood Bank.
†*oxeata*, Topsent..					×	×			
†*Paratedania tarantula* (Kirkpatrick)					×	×	×		
IOPHONEÆ.									
Iophonopsis radiatus (Topsent) ..					×	×	×		
AXINELLIDÆ.									
Hymeniacidon kerguelensis, Hentschel		×							S. Africa.
centrotyla, Hentschel							×		
torquata, Topsent					×				
Thrinacophora simplex, Topsent ..					×				
†*Rhizaxinella australiensis*, Hentschel						×			Australia, S. Africa.
†*Homaxinella supratumescens*, Topsent					×	×	×		
CLAVULIDÆ.									
†*Latrunculia apicalis* var. *biformis*, Ridley and Dendy						×			
apicalis var. *basalis*, Kirkpatrick						×			
lendenfeldi, Hentschel							×		
†*Hemiastrella digitata*, sp. n. ..						×			
SUBERITIDÆ.									
Stylocordyla borealis subsp. *globosa* (Ridley and Dendy).. ..		×					×		
†*borealis* subsp. *acuata* (Kirkpatrick)						×	×		
borealis subsp. *irregularis*, Hentschel							×		
Suberites massa (Nardo)		×			×				Europe, W. Indies, S. America, Mauritius.
microstomus, Ridley and Dendy		×				×			
microstomus var. *stellatus*, Kirkpatrick						×	×		
†*papillatus* (Kirkpatrick) ..					×	×			
mollis, Ridley and Dendy ..		×							
caminatus, Ridley and Dendy		×							

LIST OF ANTARCTIC SPECIES—*continued.*

	Marion Is.	Kerguelen.	South Georgia.	South Orkneys.	Graham Land.	Victoria Land.	Wilhelm Land.	Coats Land.	Extra-Antarctic Distribution.
†*Pseudosuberites hyalinus* (Ridley and Dendy)					×	×			Europe, Red Sea, Patagonia.
†*exalbicans*, Topsent						×			Gough Is.
†*Suberella topsenti*, sp. n.						×			Burdwood Bank.
†*Polymastia invaginata*, Kirkpatrick						×	×		
insidis var. *simplex*, Hentschel							×		
†*Sphærotylus antarcticus*, Kirkpatrick						×	×		
schœnus (Sollas)						×	×		
EUCERATOSA.									
†*Aplysina minima*, Hentschel ..						×	×		
†*Hircinia variabilis*, Schulze ..						×			Almost cosmopolitan.
†*Spongelia oculata*, *sp.n.*						×			
†*Dendrilla membranosa* (Pallas) ..					×	×	×		Indian Ocean, Australia.

IV.—SYSTEMATIC NOTES AND DESCRIPTION OF SPECIES.

ORDER CALCAREA.

IT is questionable whether sufficient allowance has been made hitherto for the individual variations in external form or in the shape and size of the spicules of calcareous sponges. Particularly is this so in the case of the Antarctic sponges described by Jenkin (1908). In studying the " Terra Nova " collections, particular attention has been paid to the variations of this kind, with Minchin's notes as a guide, with the result that it has been possible to reduce the number of valid species considerably.

FAMILY HOMOCOELIDÆ.

Leucosolenia botryoides (Ellis and Solander).

Spongia botryoides, Ellis and Solander 1786, p. 190, pl. lviii, figs. 1–4 : *S. complicata*, Montagu 1912, p. xcvii, pl. ix, figs. 2, 3 : *Leucosolenia variabilis*, Haeckel 1869*a*, p. 243 : *Ascandra botrys*, Haeckel 1872, p. 101, pl. xvi, figs. 1 *a–f* : *Leucosolenia lucasi*, Dendy 1891, p. 45, pl. i, fig. 1, pl. iv, fig. 1, pl. ix, fig. 1 : *L. discoveryi*, Jenkin 1908, p. 6, pl. xxviii, figs. 12–13 : *L. minchini*, Id. i, p. 8, pl. xxviii, figs. 14–15 : *L. incerta*, Urban, 1909, p. 5, pl. i, fig. 1.
(For further synonymy see Dendy and Row 1913, pp. 721–723.)

The seven species enumerated above are remarkably similar in external form and possess the same categories of spicules, and the only reason for their separation has been the differences spicule-size and in the general appearance of the sponge.

Nevertheless, according to Minchin (l.c.), both of these are extremely variable in at least three of the species so that I feel convinced that all the seven so-called species are nothing more than forms of the same species growing in differing habitats. Certainly those forms recorded by Jenkin (l.c.) from the Antarctic under the names *L. complicata*, *L. discoveryi* and *L. minchini* belong to one species.

Leucosolenia coriacea (Montagu).

Spongia coriacea, Montagu 1818, p. 116: *Leucosolenia lamarckii*, Haeckel 1869*a*, p. 243: *Prosycum primordialis*, Id. l.c., p. 236.
(For further synonymy see Dendy and Row 1913, pp. 725–726.)

I regard these three species as forms of a single species for the reasons given under *L. botryoides*. In fact, after examining a number of specimens of all three, it is hard to see why the distinction was ever made.

Family LEUCALTIDÆ.

Leucettusa lancifer, Dendy.

L. lancifer, Dendy 1924, p. 278, pl. i, figs. 11–18.

Occurrence.—Reg. 41, 42, stn. 220, off C. Adair, 45–50 faths.: Reg. 48, stn. 331, McMurdo Sound, 250 faths.

Family GRANTIIDÆ.

Grantia hirsuta (Topsent).

Leucandra hirsuta, Topsent 1907β, p. 541; Id. 1908, p. 7; *L. cirrata*, Jenkin 1908, p. 18, pl. xxxi, figs. 54–56: *Grantia tenuis*, Urban 1909, p. 14, pl. ii, figs. 43–55, pl. iii, figs. 1, 2: *G. tenuis*, Dendy and Row 1913, p. 760: *Leucandra cirrata*, Id. l.c., p. 770: *L. hirsuta*, Id. l.c., p. 770: *Grantia cirrata*, var. *auroræ*, Dendy 1918, p. 11: *G. tenuis*, Id. l.c., p. 12.

The species is particularly variable in respect of the various categories of oxea, so that it is small wonder that it should have been described under several different names. I have been able to examine the types of *Leucandra cirrata* and its var. *auroræ* and, after comparison with the very full descriptions originally given of *L. hirsuta* and *Grantia tenuis*, have little hesitation in including them under one name.

Grantia chartacea (Jenkin).

Dermatreton chartaceum, Jenkin 1908, p. 22, pl. xxvii, fig. 5, pls. xxxi, xxxii: *D. hodgsoni*, Id. l.c., p. 23, pl. xxvii, fig. 1, pl. xxxii, figs. 65–74: *Tenthrenodes scotti*, Id. l.c., p. 10, pl. xxvii, fig. 9, pls. xxviii, xxix: *Grantia chartacea*, Dendy and Row 1913, p. 759: *G. hodgsoni*, Id. l.c., p. 760: *G. scotti*, Id. l.c., p. 760.

I have examined the types of these three species and can see no reason for separating them.

Achramorpha truncata (Topsent).

Grantia truncata, Topsent 1908, p. 6, pl. v, fig. 4.

Occurrence.—Reg. 250, stn. 339, off McMurdo Sound, 140 faths.

The collection contains a fragmentary vase-shaped specimen of this species. The agreement between it and the holotype is very close.

It may well be doubted whether all four species of this genus from the Antarctic represent anything more than forms of one species.

Megapogon villosus, Jenkin.

Megapogon villosus, Jenkin 1908, p. 37, pl. xxxvi, figs. 115–119: *M. raripilis*, Id. l.c., p. 38, pl. xxxvii, figs. 120–124: *M. pollicaris*, Id. l.c., p. 40, pls. xxxvii, xxxviii, figs. 125–130: *M. crispatus*, Id. l.c., p. 41, pl. xxvii, fig. 2, pl. xxxviii, figs. 131–136.
(For further synonymy see Dendy and Row 1913, p. 768.)

I see no reason to regard the "Discovery" sponges, which Jenkin divided into four species of *Megapogon*, as anything more than simple varieties of a single species.

Genus LEUCONIA, Grant (1833).

Genotype: *Spongia nivea*, Grant.

Considerable doubt exists as to whether this genus should be known as *Leuconia* or *Leucandra*. Several authors have persisted in the use of the former name (e.g. Bowerbank 1864, Gray 1867, Poléjaeff 1884, and Urban 1909), but none have thought it worth while to mention the original reference to the genus. Haeckel (1872) founded the genus *Leucandra*, in which he included *Leuconia nivea*, without reference to the genus *Leuconia* itself. Dendy and Row 1913 adopted Haeckel's nomenclature, again without comment. On the other hand, as Dr. G. P. Bidder has pointed out to me, Vosmaer 1887 states, "Der Name *Leuconia* ist schon 1825 einem Mollusken vergeben." No reference is given and I have been unable, even with the kind assistance of Mr. C. D. Sherborn, to discover where the name was used. In the circumstances, therefore, we must revert to Grant's name *Leuconia*.

Leuconia levis, Poléjaeff.

L. levis, Poléjaeff 1884, p. 58, pl. vii, fig. 4.

Occurrence.—Reg. 50, stn. 339, off McMurdo Sound, 140 faths.

Leuconia frigida (Jenkin).

Leucandra frigida, Jenkin 1908, p. 15, pl. xxvii, fig. 6, pls. xxix, xxx: *L. brumalis*, Id. l.c., p. 16, pl. xxx, figs. 41–43: *L. gelatinosa*, Id. l.c., p. 17, pl. xxx, figs. 44–53: *L. mawsoni*, Dendy 1918, p. 13, pl. i, figs. 5, 10.

Leuconia joubini (Topsent).

Leucandra joubini, Topsent 1907*β*, p. 542; Id. 1908, p. 9: *Leucetta macquariensis*, Dendy 1918, p. 9, pl. i, figs. 3, 8.

There appears to be no valid reason for separating Dendy's Macquerie Island species from *Leuconia joubini* (Topsent).

Family LEUCASCIDÆ.

Leucetta leptoraphis (Jenkin). (Pl. V, figs. 1–4.)

Leucandra primigenia var. *leptoraphis*, Jenkin 1908, p. 14, pl. xxix, figs. 33–34: *Leucetta antarctica*, Dendy 1918, p. 8, pl. i, figs. 2–7.

Occurrence.—*Reg. 34, 35, 38, stn. 331, off McMurdo Sound, 250 faths.: Reg. 36, stn. 220, off C. Adair, 45–50 faths.: Reg. 37, stn. 339, off McMurdo Sound, 140 faths.: Reg. 39, stn. 314, Inaccessible Is., 222–241 faths.: Reg. 40, stn. 194, off Oates Land, 180–200 faths.

The Antarctic forms described by Jenkin (l.c.) undoubtedly represent a species quite distinct from *L. primigenia* (Haeckel). The external form is extremely variable and ranges from simple or branching tubes to massive forms with numerous vents scattered over the surface. In the tubular forms, the centre of the sponge is occupied by a wide pseudogaster running from the base to the oscule at the apex. In the massive forms, the exhalant currents are conveyed by numerous smaller canals which penetrate the sponge in various directions but running generally from the base to the oscula on the surface. The massive sponges are undoubtedly derived from the simple, tubular forms by repeated branching and coalescence.

The colour, in spirit, varies from greyish-white to olive-green, or even pink.

The nuclei of the collared cells are basal.

Embryos, in the blastosphere stage, are present in large quantities in some of the specimens.

Order HEXACTINELLIDA.

Family ROSSELLIDÆ.

Genus ROSSELLA, Carter.

Genotype: *Rossella antarctica*, Carter.

Synonymy:—*Aulorossella*, Kirkpatrick 1907*a*, p. 14: *Anaulosoma*, Id. l.c., p. 20.

Reasons for including Kirkpatrick's two genera in the genus *Rossella* will be found below under *R. nuda*, Topsent.

The Antarctic representatives of this genus have been held to number hitherto some twenty-four species, subspecies and varieties. In my opinion, undue importance has been attached to small variations in spicule size and form, and to small variations in the external form. It is doubtful whether the species of *Rossella* found in the Antarctic number more than four.

After examining a considerable amount of material I consider it probable that

* All the Terra Nova sponges have been entered in the British Museum catalogue under the registered numbers 26.10.26. 1, 26.10.26. 2, &c. To obtain the full registered number of any given specimen it is necessary to add 26.10.26 to the number given in this report (e.g. Reg. 34, &c.).

the spicules of the Hexactinellida are more variable than those of other groups of sponges. The rays of the parenchymal hexactins and diactins may be wholly or partially spined or entirely smooth, and sharply or obtusely pointed; the gastralia, which are normally pentactin, may be occasionally hexactin or even, rarely, stauractin. The spicule-forms known as holo-, hemi-, and monoxyasters are simply examples of the degree to which an oxyaster may vary, and one, two, or all three forms may be found in different individuals of a single species. The capitulum may or may not be present in the calycocomes and its presence or absence does not appear to have any taxonomic significance. The numerical proportions of the different types of spicules have sometimes been used as a basis for specific distinction (Schulze and Kirkpatrick 1910*a*, p. 31). The mere fact that of two categories of spicules, the first is predominant in one individual and the second predominant in another does not imply a specific or even varietal difference, since the numerical proportions may vary widely within the limits of species whose integrity is unquestioned. Occasionally one form of spicule is abundantly present almost to the exclusion of other forms, or it may be almost entirely absent. This holds true for both megascleres and microscleres.

The four Antarctic species and their subspecies recognised in this report resemble each other so closely in size and shape of spicules that it is necessary to look elsewhere for good specific characters. These are to be found in the nature and disposition of the pentactin dermalia and basalia.

Key to the Antarctic species of Rossella.

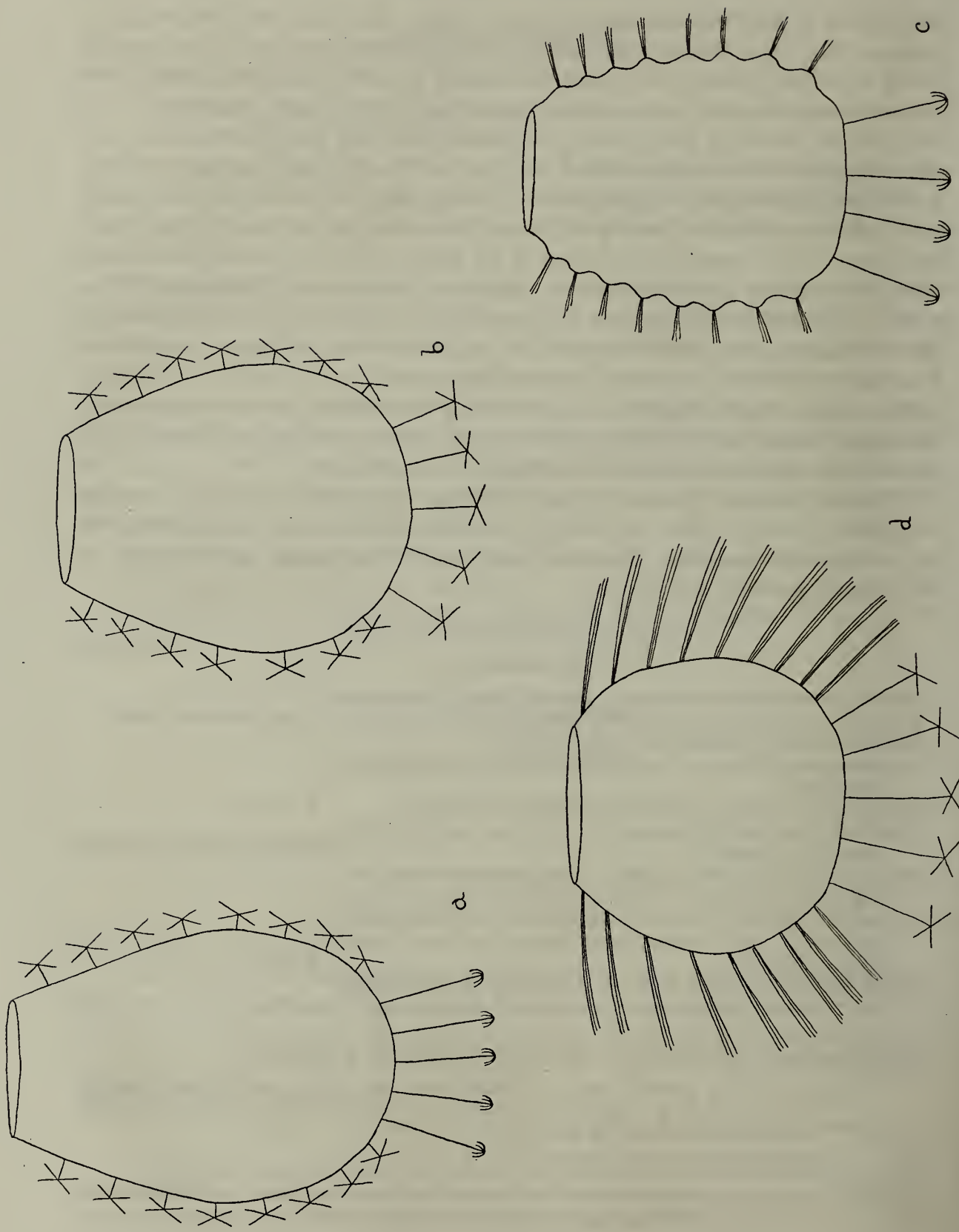
(See also text-fig. 1.)

1.	Root-tuft present or if absent sponge not attached directly to substratum	2.
	Root-tuft absent and sponge attached to substratum	*R. antarctica* subsp. *solida*.
2.	Pentactins abundantly distributed over whole surface	4.
	Pentactins confined almost exclusively to root-tuft, rarely appearing on upper parts	5.
3.	Pentactins of root-tuft resembling those found on rest of body	*R. racovitzæ*.
	Pentactins of root-tuft with actines smaller and more anchor-like than those of the pleuralia	*R. antarctica* subsp. *antarctica*.
4.	Basalia with very long, slender shafts and slightly recurved actines, root-tuft having the texture of coarse cotton-wool; surface of sponge even or covered to a greater or lesser extent with low mammiform conules and with or without small localised bundles of slender diactinal pleuralia	*R. nuda*.*
	Basalia with stout shafts and short actines, the angle between the shaft and the actines being about 90°, forming a stiff, erinaceous tuft ..	*R. villosa*.

Rossella antarctica, Carter subsp. *antarctica*, Schulze and Kirkpatrick.

Rossella antarctica antarctica, Schulze and Kirkpatrick 1910*a*, p. 17: *Rhabdocalyptus australis*, Topsent 1901, p. 6; 1901*b*, p. 37, pls. ii, iv, v: *Rossella antarctica gaussi*, Schulze and Kirkpatrick 1910*a*, p. 17, pl. ii, fig. 1.
(For further synonymy see Kirkpatrick 1907*a*, p. 5.)

* The root-tuft may occasionally be absent in *R. nuda*, but the sponge is never attached to the substratum by a short stalk or a thin basal plate as in *R. antarctica* subsp. *solida*.



TEXT-FIG. 1.—Diagram illustrating the shape of the body and the nature of the dermalia and basalia in (*a*) *Rossella antarctica*; (*b*) *R. racovitzæ*; (*c*) *R. nuda*; and (*d*) *R. villosa*.

Occurrence.—Reg. 57, stn. 356, off McMurdo Sound, 50 faths. : Reg. 80, 81, 82, McMurdo Sound (depth unknown) : Reg. 83, stn. 194, off Oates Land, 180–200 faths. : Reg. 210, 211, 212, stn. 316 , off McMurdo Sound, 190–250 faths. : Reg. 213, stn. 331, off McMurdo Sound, 250 faths.

Diagnosis.—The hypodermal pentacts, with long, prominent actines, project well beyond the ectosome forming a velum ; there is a palisade of vertically projecting diacts around the margin of the osculum ; the discohexasters have slender rays not differentiated into two categories ; the basalia are smaller than the pleuralia and are altogether different in character ; (the asexual ?) buds are small and become detached from the parent at an early stage in development. (See text-fig. 1 *a*.)

Remarks.—The species is obviously extremely variable, particularly in the characters of the smaller spicules (*vide* Kirkpatrick 1907*a*, pl. 4, figs. 2, 3, and Schulze and Kirkpatrick 1910*a*, pl. 1, fig. 2). It is idle therefore to insist on small variations in this and other members of the genus *Rossella* as indications of the existence of distinct species, subspecies or varieties.

The main and, in fact, the only difference between the typical form of *R. antarctica antarctica* and *R. antarctica gaussi* is, according to Schulze and Kirkpatrick (1910*a*, p. 18), that the primary rays of the calycocomes measure 0·012–0·016 mm. long and 0·003 mm. thick in the former and 0·018–0·022 mm. long and 0·0028–0·003 mm. thick in the latter. The " Gauss " specimens are very obviously young individuals of subsp. *antarctica*.

Rhabdocalyptus australis Topsent is clearly a synonym of the same subspecies.

Rossella racovitzæ, Topsent. (Pl. I.)

Rossella racovitzæ, Topsent 1901, p. 5 ; Id. 1901*b*, p. 33, pl. i, fig. 5, pl. iv, figs. 1–7 : *R. podagrosa*, Kirkpatrick 1907*a*, p. 11, pl. iii, figs. 2–3, pl. v, fig. 1 : *R. hexactinophila*, Id. l.c., p. 12, pl. iii, fig. 4, pl. vi, fig. 1 : *R. racovitzæ*, Id. l.c., p. 14, pl. i, fig. 5, pl. iv, figs. 1–7 : *R. racovitzæ racovitzæ*, Schulze and Kirkpatrick 1910*a*, p. 20, pl. iii, fig. 2 : *R. racovitzæ minuta*, Schulze and Kirkpatrick 1910, p. 296 ; 1910*a*, p. 21, pl. iii, fig. 1 : *R. gaussi*, Schulze and Kirkpatrick 1910, p. 297 ; 1910*a*, p. 23, pl. iv, figs. 1–2 : *R. lynchnophora*, Schulze and Kirkpatrick 1910, p. 298 ; 1910*a*, p. 25, pl. iii, fig. 4 : *R. fibulata*, Schulze and Kirkpatrick 1910, p. 298 ; 1910*a*, p. 27, pl. vii, fig. 2 : *?R. sp.*, Schulze and Kirkpatrick 1910*a*, p. 29, pl. iii, fig. 5 : *R. mixta*, Schulze and Kirkpatrick 1910, p. 299 ; 1910*a*, p. 29, pl. iii, fig. 3 : *R. racovitzæ*, Topsent 1917, p. 9, pl. iv, figs. 7–8 : *R. racovitzæ microdiscina*, Id. l.c., p. 12, pl. iv, fig. 10, pl. v, fig. 5 : *R. podagrosa*, Id. l.c., p. 14 : *R. podagrosa tenuis*, Id. l.c., p. 15.

Occurrence.—Reg. 53, 54, 208, 209, 282, stn. 316, McMurdo Sound, 190–250 faths. : Reg. 60, 88, 89, stn. 194, off Oates Land, 180–200 faths. : Reg. 59, stn. 314, McMurdo Sound, 222–241 faths. : Reg. 55, stn. 355, off McMurdo Sound, 300 faths. : Reg. 61, stn. 331, McMurdo Sound, 250 faths. : Reg. 67, stn. 339, off McMurdo Sound, 140 faths.

Diagnosis.—The hypodermal pentacts form a velum but are more sparsely distributed and the velum less dense than in *R. antarctica antarctica ;* there is no definite palisade or fringe of vertically directed diacts around the margin of the oscule, but long

diacts, usually distributed singly, project beyond the feebly-formed velum especially in the adult, where they are found particularly towards the upper portions of the sponge projecting outwards and upwards ; the rays of the discohexasters are differentiated into two categories ; the basalia resemble the pleuralia in size and shape ; the (asexual ?) buds are large and remain attached to the parent until a comparatively late stage in development. (See text-fig. 1 *b*.)

Remarks.—The original types of this species illustrate the external form very well (cf. also fig. 1 *b*). According to Topsent (1901δ, p. 34) there is no velum in the type specimens for " ses pentacts hypodermiques, au lieu de dépasser la surface, restent constamment implantés dans l'épaisseur de son ectosome." The same holds true for the single specimen described by Kirkpatrick (l.c.). The fourteen examples described by Schulze and Kirkpatrick (1910*a*) possessed a velum formed by the hypodermal pentacts, which " treten mehr oder weniger heraus und bilden ein undeutliches Velum." The last-named authors (l.c.) appear to have held the view that the absence or presence of a velum in species of Rossella is of no taxonomic importance, and all available evidence supports this view. In *R. antarctica* the degree to which a velum may be developed varies, but I have not seen a specimen in which it is entirely absent. In *R. nuda* (*vide infra*) it is characteristically absent and, so far as I have observed, is not even represented by occasional pentacts protruding from the apices of the surface conules. In *R. villosa* sp.n., it is characteristically absent but may be represented by the few pentacts which are occasionally found associated with the surface bundles of diacts. The four species form a series which illustrates how a single character may be developed to different degrees of intensity in different species of a single genus, a fact not generally, or sufficiently, recognised. Thus, in *R. antarctica* the velum may be strongly or feebly developed ; in *R. racovitzæ* feebly developed or absent ; in *R. villosa* it is characteristically absent or represented by a few isolated pentacts ; while *R. nuda* is entirely without a velum throughout the species. The surface in *R. racovitzæ* is usually conulose, though not to the same extent as in *R. nuda*, but it may be smooth and even.

It is obvious from even a casual examination that the various species and subspecies included in the above list as synonyms of *R. racovitzæ*, form a compact group of very closely allied forms. When, as now, it is seen that such differences in spicule-form as have been used in the diagnosis of these species and subspecies are but normal variations, there can be no question of maintaining such distinctions.

Apart from the negligible differences in the size of the calycocomes and oxyhexasters of the two species, *R. podagrosa* and *R. hexactinophila* differ in one respect only, that the former has a mixture of hexactin and pentactin autodermalia while the latter has hexactin autodermalia only. This we now know to be of no systematic importance. Both resemble *R. racovitzæ* except in the absence of a velum.

R. racovitzæ racovitzæ and *R. racovitze minuta*, Schulze and Kirkpatrick 1910*a*, (pp. 20–21) differ only in the size of the calycocomes and microdiscohexasters. Subsp.

minuta is certainly nothing more than a young form of the species of which Topsent's types represent the half-grown adults.

R. gaussi and *R. lynchnophora*, the former characterised by " die grosse Häufigkeit der Discohexaster und die Seltenheit der Oxyhexaster " and very slight differences in the size and form of rays of the autogastral hexactins, are obvious synonyms of *R. racovitzæ*. Indeed, Schulze and Kirkpatrick (1910*a*, p. 27) suggested as much with regard to *R. lynchnophora*.

The heterostauractins, -triactins, and -diactins of *R. fibulatus* must be regarded merely as abnormal forms of the oxyhexaster and of no more importance than the similar abnormalities found in all other groups of sponges (cf. *Stelletta crater, infra*). But for these spicules the species differs in no way from *R. racovitzæ*.

Rossella nuda, Topsent. (Pl. II.)

Rossella nuda, Topsent 1901, p. 4; Id. 1901*b*, p. 32, pl. i, figs. 7, pl. iv, fig. 8–13: *Hyalascus hodgsoni*, Kirkpatrick 1907*a*, p. 3, pl. iii, fig. 1, pl. iv, fig. 1: *Aulorossella pilosa*, Id. l.c., p. 16, pl. ii, fig. 1, pl. vi, fig. 2: *A. levis*, Id. l.c., p. 17, pl. ii, figs. 2, 3, pl. vi, fig. 3: *A. longstaffi*, Id. l.c., p. 19, pl. ii, fig. 4, pl. vii, fig. 1: *Anaulsoma schulzii*, Id. l.c., p. 21, pl. iii, figs. 5, 6, pl. v, fig. 2: *Aulorossella vanhöffeni vanhöffeni*, Schulze and Kirkpatrick 1910, p. 300; Id. 1910*a*, p. 33, pl. v, fig. 1, pl. vi, fig. 1: *A. vanhöffeni armata*, Id. 1910, p. 301; Id. 1910*a*, p. 36, pl. vi, figs. 2–5: *A. gaini*, Topsent 1917, p. 18, pl. v, fig. 2: *A. aperta*, Id. l.c., p. 20, pl. iv, fig. 4, pl. v, fig. 3.

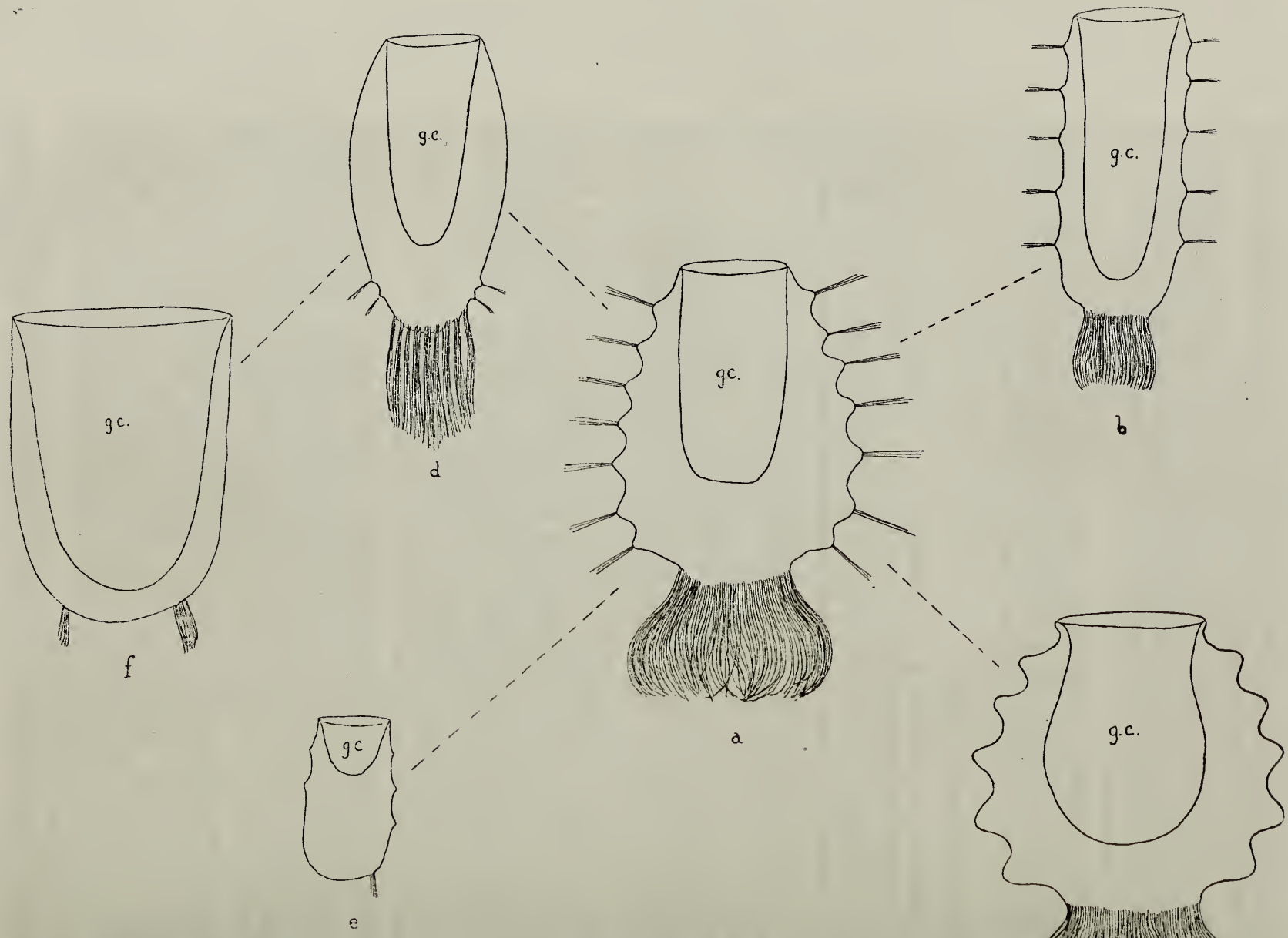
Occurrence.—Reg. 58, 66, stn. 331, off McMurdo Sound, 250 faths.: Reg. 251, 252, stn. 316, McMurdo Sound, 190–250 faths.: Reg. 253, 256, 257, 259, 260, stn. 349, McMurdo Sound, 80 faths.: Reg. 108, 254, 255, 258, stn. 356, off McMurdo Sound, 50 faths.

Diagnosis.—Without velum; the hypodermal pentacts are localised at definite points on the surface of the sponge but do not project beyond the ectosome; surface even or thrown to a varying extent into surface conules; bundles of projecting diacts may be present at the apex of the conules; basalia long and slender, seldom more than 0·1 mm. thick, with short recurved rays. (See text-fig. 1 *c*.)

Remarks.—Rossella nuda differs from *R. antarctica* almost entirely in that the hypodermal pentacts do not project beyond the autodermalia.

Comparing *R. nuda* and *Aulorossella pilosa*, it is evident that the two species differ in one respect only, if the small and unimportant differences in the size of the various spicules be ignored, that the surface of *R. nuda* is comparatively even and bears no projecting bundles of pleuralia, while that of the second species is thrown into conules each of which bears at the apex a bundle of pleuralia. Further, there is a striking resemblance between the external appearance of the two species, particularly in the texture of the basal tuft, and since, as I shall point out later, there is sufficient evidence from the " Terra Nova " material to show that the conules, in a group of sponges belonging obviously to the same species, may be absent or present to a varying degree and that the pleuralia may or may not project beyond the surface, there is no further reason for separating the two species.

Aulorossella levis differs from *A. pilosa* in that the autogastralia are pentactins



TEXT-FIG. 2.—*Rossella nuda*, Topsent. Diagram illustrating the variations in external form met with in the species: (*a*) *pilosa-levis*-form, the most common form and therefore probably the typical form; (*b*) *aperta*-form, with surface conules and the projecting bundles of diactinal pleuralia reduced; (*c*) a form commonly found in the present collection, without projecting pleuralia, but with the surface conules strongly developed; (*d*) *vanhöffeni*-form, with comparatively smooth surface almost devoid of surface conules and of projecting pleuralia; (*e*) *longstaffi*-form, abnormal (possibly pathological) with shallow gastral cavity, no projecting pleuralia and a vestigial basal tuft; (*f*) unusual form found among the "Terra Nova" specimens, without projecting pleuralia or surface conules and with vestigial basal tuft.

instead of hexactins. From my observations, it is certain that these spicules are variable in form and may be pentactin or hexactin, or a mixture of both. On rare occasions they may be reduced to stauractins. Clearly then, *A. levis* is also a synonym of *Rossella nuda*.

Aulorossella longstaffi, on the other hand, differs from *Rossella nuda* in that the surface is thrown into conules, the gastral cavity is shallow and there is no basal tuft. The first difference has been shown to be comparatively insignificant. Regarding the third, there is some evidence that the degree of development of the basal tuft is subject to variation and I am inclined to think that it may occasionally be absent even in more normal individuals of the species. The small size of the gastral cavity appears to be due to the fact that the sponge called *A. longstaffi* by Kirkpatrick is in reality a deformity or " monstrosity " belonging to the species *Rossella nuda* and that the cavity has been to some extent obliterated by hypertrophy of the adjacent tissues. In any case the sponge has so much in common with the other members of the species that I think there can be no doubt as to its identity with *Rossella nuda*.

Aulorossella vanhöffeni vanhöffeni, *A. gaini* and *A. aperta* differ among themselves and from *Rossella nuda* in the degree to which the surface conules and projecting pleuralia are developed and in small differences in the size and shape of the spicules. The comparative account of the morphology of *R. nuda* as here understood, given below, will help to place the differences between these various species in their correct proportion.

A. vanhöffeni armata is obviously a young form of *A. vanhöffeni vanhöffeni* and does not constitute a sub-species. It is worthy of note that in the several specimens assigned by Schulze and Kirkpatrick to *A. vanhöffeni armata* some have surface conules and others have not, so that the variability in this feature is evidently not confined to the adult.

Hyalascus hodgsoni differs from the species already mentioned in the absence of calycocomes. Categories of microscleres may drop out as readily and as frequently in the Hexactinellida as in the Tetraxonida. Some of the present specimens of Rossellidæ not only lack calycocomes but possess remarkably few discohexasters and the absence of one, or even more, categories of microsclere, all other things being equal, is no evidence of the existence of a distinct species or even of a distinct variety (cf. Schulze and Kirkpatrick 1910*a*, p. 14).

Anaulosoma schulzii must be regarded as a synonym of *Rossella nuda*, because the type specimens are nothing more than the papillæ torn from a large specimen, or specimens, of " *Aulorossella levis*." Among the " Terra Nova " Rossellids was a jar of specimens similar in all respects to those described by Kirkpatrick as *Anaulosoma schulzii*, but it was clear that they must be papillæ detached from the large dried specimens so abundantly present in the collection. Actually, I was able to find the exact places, on the larger specimens, from which they had been torn. The surface described by Kirkpatrick as the gastral surface is really the torn surface. This would explain the absence of the hypodermal pentacts, or rather, the apparent absence. The " few

small tufts of diactin basalia extending downwards" are really the bundles of diacts found at the apex of the surface conules in a complete specimen of "*Aulorossella levis*." The apex of the two figured specimens of *Anaulosoma schulzii* is bifid, a character which is rare but not unknown in the conules of these species of *Rossella*, and it is probable that they were selected by the collector for special preservation because of this unusual character. The other two specimens described, but not figured, by Kirkpatrick, are pieces of the dermal surface bearing, in one case, two and, in the other case, several conules.*

The thirteen examples contained in the "Terra Nova" collections show quite clearly that it is impossible to separate the various forms contained in the above synonymy list into separate species or even sub-species. All either belong to or are intermediate between the *pilosa*- or *levis*- forms, or to a new form, shown in fig. 2 *c*, of *R. nuda*, in which the surface is devoid of projecting spicules, except at the base, and is beset with strongly developed conules instead.

Regarding the variation in the development of the surface conules in this species, it is of importance to note that a similar but less clearly-marked variation of the surface exists in *Rossella antarctica* and *R. racovitzæ* but that it is masked by the velum.

In Text-fig. 2, an attempt is made to illustrate the variation in external form found in this species. Fig. 2 *a* shows the most typical form.

Rossella villosa, sp. n. (Pl. III.)

Diagnosis.—Without velum but occasional, isolated, projecting pentactins may be seen associated with the surface bundles of diacts; the surface may or may not be conulose, but is always covered by projecting bundles of stout diacts; basalia stout without short actines, never less than 0·2 mm. in thickness and usually between 0·3 and 0·4 mm. thick. (See text-fig. 1 *d*.)

Occurrence.—Reg. 261–278, stn. 349, McMurdo Sound, 80 faths.: Reg. 279–281, stn. 194, off Oates Land, 180–200 faths.

Remarks.—The holotype, the largest of the twenty specimens, is a typical example of the species, sac-shaped, more or less spherical in outline, with a capacious gastral cavity. It has a total height of 30 cms. including the basal root-tuft, is 16 cms. in diameter at the widest point and bears an apical oscule measuring 8 cms. in diameter. The porcupine-like appearance is due to numerous bundles of long diacts, each containing about 6 spicules, which beset the entire surface, projecting outwards and slightly downwards. The diacts are usually about 13 cms. long, of which 9 cms. project beyond the ectosome, while the diameter at the centre of the spicule averages 0·3 mm. A single, occasional pentactin may be seen among the diacts. The surface is even or raised into low conules at the bases of the pleuralia. All specimens are dry and in every case

* In fairness to Kirkpatrick it must be confessed that the appearance of these papillæ is misleading and that I had spent nearly a whole day in unsuccessful attempts to identify them before the truth as to their exact nature occurred to me.

the oscular region has been slightly damaged. From the remains of broken spicules in this region, however, it appears that the sponge possessed a palisade of vertically directed diacts around the lip of the osculum, very much as in *R. antarctica antarctica*. The basalia are pentactins with stout shafts and actines directed at right-angles to the shafts. The dimensions of a single spicule are, shaft 18 cms. long and 0·4 mm. thick, actines, very variable, but frequently 1·5 mm. long.

The rest of the spiculation approximates very closely to that of *R. nuda :* in fact, I have been unable to find a single feature in the spiculation upon which a distinction between the two species might be founded. In the adult state, at all events, the present species is quite readily recognised by its distinctive external appearance.

Gymnorossella inermis, Topsent.

G. inermis, Topsent 1916, p. 164 ; Id. 1917, p. 22, pl. i, fig. 1, pl. v, fig. 4.

It is extremely doubtful whether this species is anything more than an aberrant *Rossella* which has neither diactin nor pentactin pleuralia, but which has the hypodermal pentactins confined to the basalia.

Anoxycalyx ijimai, Kirkpatrick.

Anoxycalyx ijimai, Kirkpatrick 1907*a*, p. 23 ; Schulze and Kirkpatrick 1910*a*, p. 44, pl. vii, fig. 1 ; Topsent 1917, p. 26.

Occurrence.—Reg. 73, i, ii, stn. 338, off McMurdo Sound, 207 faths.

Two typical specimens are present, the largest measuring about 2 cms. along the long axis. There are eight specimens of the species in the British Museum Collection and I find on examination that the character of the autodermalia is not constant. In the holotype they are chiefly stauractins, in the present specimens pentactins with a few hexactins and stauractins.

To the notes on the development of this species given by Schulze and Kirkpatrick (1910*a*, p. 47) the following may be added. Very early in the life of the detached buds a distinction becomes evident in the grouping of the projecting diacts with the formation of circumoral fringe and an aboral tuft. The anchor-like basalia do not appear, as a general rule, until the sponge has attained a length of between 20–30 mm. Regarding the dispersal of these asexually-formed buds, it is obvious that the species producing them will be at a disadvantage as compared with those species which produce a ciliated, free-swimming larva. It may be noted, however, that the density of the buds is approximately the same as the medium in which they live, so that probably their buoyancy is such that they do not readily sink to the bottom until an advanced stage of development is reached and will be, as a consequence, able to make use of the smallest currents as a means of dispersal.

Scolymastra joubini, Topsent.

S. joubini, Topsent 1916, p. 163 ; Id. 1917, p. 27, pl. ii, fig. 4, pl. v, fig. 1.

Occurrence.—Reg. 68–70, stn. 314, McMurdo Sound, 222–241 faths.

But for the difference in the characters of the autodermalia of this species and *Anonycalyx ijimai* Kirkpatrick, there seems little to choose between the two, in which case a generic distinction seems rather superfluous.

Order MYXOSPONGIDA.

Halisarca dujardini, Johnston var. *magellanica*, Topsent.

Halisarca dujardini, Johnston var. *magellanica*, Topsent 1901δ, p. 44, pl. i, fig. 2, pl. vi, figs. 11–14.

Occurrence.—Reg. 238, stn. 339, off McMurdo Sound, 140 faths.

Order TETRAXONIDA.

Sub-order HOMOSCLEROPHORA.

Family PLAKINIDÆ.

Plakina monolopha, Schulze.

P. monolopha, Schulze 1880, p. 407, pl. xx, figs. 1–7.

Lendenfeld (1907*a*, p. 333) recognises two sub-species of *Plakina monolopha*, viz.: subsp. *eurasia* from the Northern Hemisphere and subsp. *antarctica* from the Antarctic. The only difference apparently is that the spicules in the latter are slightly larger.

Plakina trilopha, Schulze.

P. trilopha, Schulze 1880, p. 422, pl. xx, figs. 8–11.

Here again Lendenfeld (1907*a*) recognises a subsp. *antarctica* which he claims to be distinct from the Mediterranean form. Topsent (1901δ), on the other hand, is unable to distinguish between the Mediterranean form and his Antarctic specimens.

The fact that a gap occurs in the distribution of this and the preceding species is probably because they are both somewhat rare sponges and that the South Atlantic has not been so assiduously searched as either the North Atlantic and Mediterranean or the Antarctic.

Family STELLETTIDÆ.

Stelletta maori, Dendy. (Text-fig. 3.)

S. maori, var. *bistellata*, Dendy 1924, p. 291 : *S. sandalinum* Brøndsted 1924, p. 438, fig. 3.

Occurrence.—Reg. 249, stn. 339, off McMurdo Sound, 140 faths.

A comparison of the present specimen and the holotype of *S. maori* with Brøndsted's description of *S. sandalinum* leaves no doubt as to the identity of the two species with one another. The division, partial or complete, of the microscleres into two categories

in the Stellettidæ is too common to justify the erection of a variety purely on these grounds, as in *S. maori* v. *bistellata*.

Stelletta purpurea, Ridley.

Myriastra biformis, Brøndsted 1924, p. 435, fig. 1.
(For further synonymy see Burton 1926.)

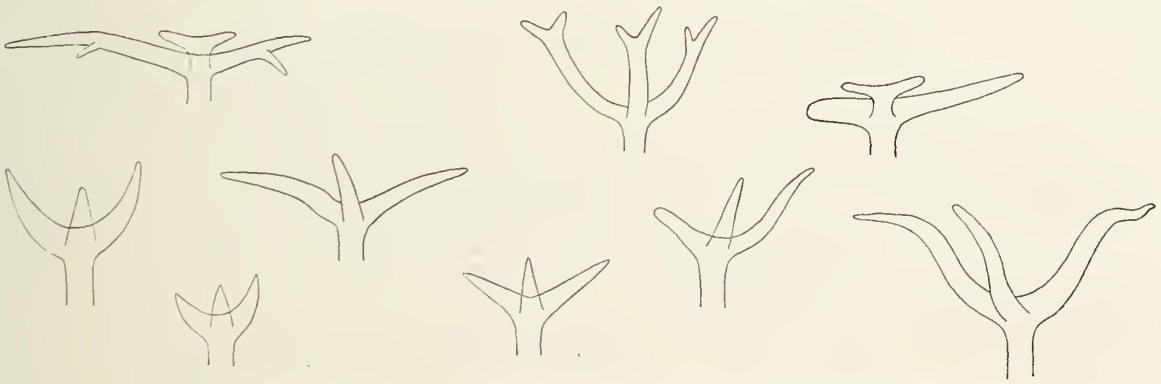
Occurrence.—Reg. 347, stn. 339, off McMurdo Sound, 140 faths.

Myriastra biformis is a typical example of the common species *Stelletta purpurea*.

Stelletta crater, Dendy.

S. crater, Dendy 1924, p. 292, pl. ix, fig. 5, pl. vii, figs. 5–7.

Occurrence.—Reg. 250, stn. 339, off McMurdo Sound, 140 faths.



Text-fig. 3.—*Stelletta maori*, Dendy. Various forms of abnormal cladi found in the triænes of R.N. 249.

Jaspis novæ-zealandiæ, Dendy.

J. novæ-zealandiæ, Dendy 1924, p. 305, pl. vii, figs. 20–23.

Occurrence.—Reg. 283, stn. 339, off McMurdo Sound, 140 faths.

Penares tylotaster, Dendy.

P. tylotaster, Dendy 1924, p. 303, pl. vii, figs. 16–19.

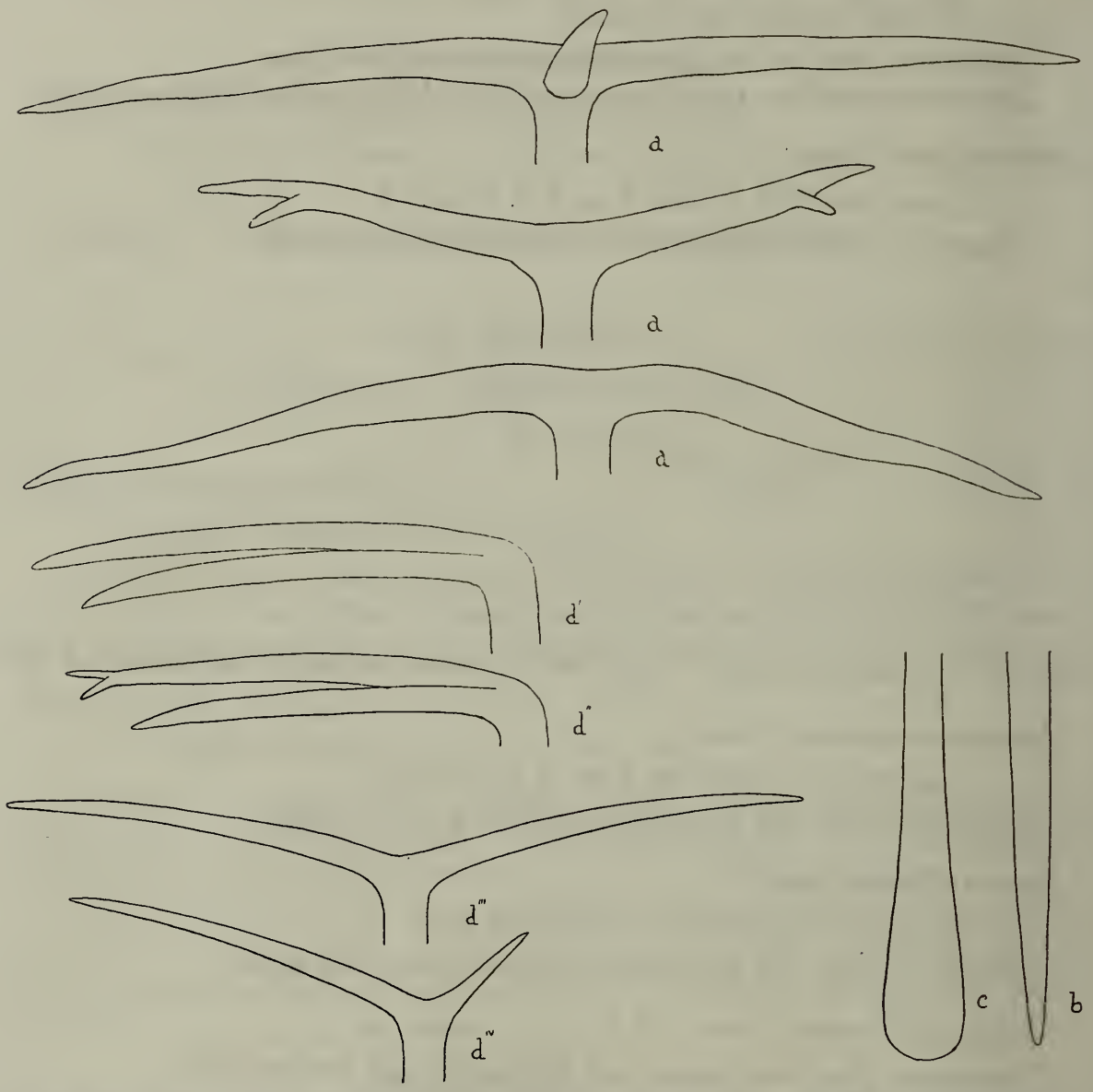
Occurrence.—Reg. 348, stn. 339, off McMurdo Sound, 140 faths.

Monosyringa brondstedi, **sp. n.** (Pl. IV, fig. 1, text-fig. 4.)

Occurrence.—Reg. 285, 286, stn. 316, McMurdo Sound, 190–250 faths.

The holotype Reg. 285 consists of a spherical body, 23 mm. in diameter, from which three oscular tubes are given off, the largest measuring 20 mm. long and 3 mm. in diameter. The latter are very fragile and the ends have been considerably damaged so that it is impossible to decide whether they were closed or open in life. The surface of the sponge is covered with a layer of small pebbles, fragments of polyzoa, and other débris held in position by slender ectosomal processes. The processes are filled with tylasters and the ends are trumpet or funnel-shaped and appear to form adhesive discs

which hold the débris in position on the surface of the sponge. *Monosyringa* (*Tribrachion*) *longispinum* (see Lendenfeld 1907*a*, pl. 24, figs. 6, 7), a closely-related species from the Antarctic, has similar processes but the surface of the sponge is without the coating of débris found in the "Terra Nova" specimens. Brøndsted (1924, p. 442), referring to



TEXT-FIG. 4.—*Monosyringa brondstedi*, sp. n. (*a*) Triænes and diænes of the radial bundles of the body, × 100; (*b*) normal and (*c*) occasional abnormal endings of the shafts of the triænes and diænes of the radial bundles, × 100; (*d*) various forms of cladi found in the diænes of the oscular tubes, × 100.

a third, and again closely-related species from New Zealand, remarks, "the surface of the body is completely covered with sand, fragments of shells, etc.; the sand grains can only with difficulty be removed from the sponge; where they have been there are seen small corresponding hollows in the surface of the sponge."

The pores are difficult to locate but appear to be situated in the " intercladal areas " (see Sollas 1888, p. 154). The walls of the oscular tubes are perforated by groups of pores, each pore about 0·016 mm. in diameter, a precisely similar state of affairs to that found in *Tribrachium schmidtii* (*cf.* Sollas, l.c.), so that it may reasonably be inferred that the ends of the cloacal tubes are closed in life, as in the species of *Tribrachium*.

The cortex is slightly fibrous and 0·5 mm. thick.

The skeleton is radial and composed of bundles of oxea and triænes set at regular intervals with an occasional single triæne between the bundles. The triænes of the body are orthotriænes usually more or less modified to form dichotriænes, anatriænes and orthodiænes. The cortex is abundantly filled with small tylasters while the choanosome contains large quantities of both tylasters and oxyasters. The oscular or cloacal tube is supported by a series of orthodiænes whose rays are usually bifurcated at the ends.

Spicules.—1. *Oxea*, straight, 4·0 mm. long by 0·048 mm. thick.

2. *Triænes* of the radial bundles.

(*a*) *Orthotriænes*, usually with one or more of the rays bifurcating. Cladi variable in shape but usually more or less undulating in outline, 0·72 by 0·048 mm. Shaft, straight, often truncated or even dilated at the proximal end, 3 to 4 mm. long by 0·06 mm. thick.

(*b*) *Orthodiænes*, with straight shaft 2·4 mm. by 0·04 mm. The cladi, which measure on an average 0·5 mm. by 0·05 mm., vary considerably in length and in the angle they make with the shaft. Often they are bifurcate. The average length of a cladus is 0·5 mm. and the thickness 0·05 mm.

(*c*) *Anatriænes*, with straight shaft, 3·0 by 0·022 mm., and cladi 0·12 mm. long.

3. *Orthodiænes*, of the cloacal tube, with straight shaft and gently undulating cladi. Shaft 4·0 mm. long by 0·07 mm. thick. Cladi about 1·5 mm. long by 0·06 mm. thick, usually bifurcating at about 0·5 mm. from the free end.

4. *Chiasters*, with numerous conical, truncate or slightly tylote rays, scattered throughout both cortex and choanosome, 0·012 mm. in diamter.

5. *Choanosomal oxyasters* with from 5 to 20 rays and a diameter up to 0·06 mm.

Numerous embryos are present, almost spherical but slightly longer in one plane, 0·18 by 0·144 mm. The specimen is almost identical in external form with both *Monosyringa* (*Tribrachion*) *longispinum* (Lendenfeld) and *M. mortenseni* Brøndsted, and differs from them only in the shape of the triænes and the sizes of the microscleres.

Family GEODIIDÆ.

Geodinella vestigifera, Dendy.

G. vestigifera, Dendy 1924, p. 313, pl. viii, figs. 29–37.

Occurrence.—Reg. 183, stn. 339, off McMurdo Sound, 140 faths.

Since the present specimen possesses neither large oxea (spicule 4, Dendy l.c.) nor anatriænes, it may be assumed that these spicules found in the holotype were extraneous.

Sub-order SIGMATOSCLEROPHORA.

Family TETILLIDÆ.

Tetilla metaclada (Lendenfeld).

Tethyopsilla metaclada, Lendenfeld 1907, p. 135, pl. xxxiv, figs. 8–16.

Occurrence.—Reg. 339, stn. 339, off McMurdo Sound, 140 faths.

Tetilla leptoderma (Sollas).

T. leptoderma, Sollas 1886, p. 179: *T. grandis*, Id. l.c., p. 180: *T. leptoderma*, Id. 1888, p. 3, pl. i, figs. 1–15: *T. grandis*, Id. l.c., p. 10, pl. v, figs. 1, 2, 4–14: *T. grandis* var. *alba*, Id. l.c., p. 13, pl. v, fig. 3: *T. leptoderma*, Lendenfeld 1903, p. 19: *T. grandis grandis*, Id. l.c., p. 20: *T. grandis alba*, Id. l.c., p. 21: *Tethya grandis*, Id. 1907, p. 69, pl. xv, figs. 10–18: *T. sagitta*, Id. 1907*a*, p. 306, pl. xxi, figs. 1–16: *Craniella leptoderma*, Kirkpatrick 1908*β*, p. 4, pl. xi, figs. 4–14: *C. sagitta* var. *microsigma*, Id. l.c., p. 1, pl. iii, figs. 1–13, pl. ix, figs. 15, 16: *C. sagitta* var. *pachyrrhabdus*, Id. l.c., p. 4, pl. viii, figs. 14, 15, pl. ix, figs. 17–19.

Occurrence.—Reg. 344, stn. 314, McMurdo Sound, 222–241 faths.: Reg. 345, stn. 316, McMurdo Sound, 190–250 faths.

Remarks.—In *Tetilla leptoderma*, *T. grandis*, *Tethya stylifera*, *T. coactifera*, *T. sagitta*, *Craniella sagitta* var. *microsigma*, and *C. sagitta* var. *pachyrrhabdus* we have a group of sponges whose skeletons differ only in the dimensions of the spicules. The suspicion arises, therefore, that they all belong to a single species. The differences in size of the spicules may be ignored since they are not so great as those recorded for all the well-known species of Tetillidæ, such as *Cinachyra barbata*, *Craniella cranium*, etc. On the other hand, there are certain differences in the external form of these six sponges which cannot be ignored.

The holotype of *Tetilla leptoderma* is small and obviously immature and is useless for the purposes of a comparative study of external form. The mature specimens described by Sollas under the name of *T. grandis* fall into two groups: (*a*) Spherical with a pilose surface and without root-tuft, and (*b*) sub-spherical with apilose surface and well-developed root-tuft. The young forms are spherical with or without a pilose surface. *T. leptoderma* resembles the young form of *T. grandis*, therefore. *Tethya stylifera* approaches type (*b*) and *T. coactifera* type (*a*). In describing the last two species, Lendenfeld comments on their close resemblance to *T. grandis*, and it is a remarkable fact that on re-examining his types, I find that they more nearly resemble the holotype of *T. grandis* than do those specimens which he refers to this species in the same memoir. The type-specimens of *Tethya sagitta* represent the immediate post-larval stages of *T. grandis* while *Craniella sagitta* var. *microsigma* corresponds to form (*b*) of the same species. *C. sagitta* var. *pachyrrhabdus* is founded

on a fragment of sponge whose skeleton is practically identical with that of the type of *Tetilla grandis* (= *T. leptoderma*), even to the strongyles and styles on which the variety is founded. These modifications of the radial oxea are not only found in small quantities in the holotype of *T. grandis* but are present in most of the examples of the species I have examined.

Cinachyra barbata, Sollas.

C. barbata, Sollas 1886, p. 183; Id. 1888, p. 23, pls. iii, xxxix; Lendenfeld 1903, p. 27; Kirkpatrick 1905, p. 662; Lendenfeld 1907, p. 138, pl. xv, figs. 40–53; Id. 1907*a*, p. 309, pl. xxiii, figs. 20–23; Kirkpatrick 1908*β*, p. 6, pl. ix, figs. 1–14.

Occurrence.—Reg. 33, stn. 321, off Inaccessible Is., 180–250 faths.: Reg. 101, stn. 356, off McMurdo Sound, 50 faths.: Reg. 102, 341, 342, stn. 314, off McMurdo Sound, 222–241 faths.: Reg. 103, stn. 331, off McMurdo Sound, 250 faths.: Reg. 343, stn. 330, off McMurdo Sound, 140 faths.

It is interesting to note that of the six mature specimens present, four are practically devoid of the characteristic surface pile of projecting spicules and the remainder nearly so. (*Cf. Polymastia invaginata* below.)

Cinachyra antarctica (Carter).

Tethya antarctica, Carter 1872, p. 412, pl. xx: *Tetilla antarctica*, Sollas 1888, p. 42: *Cinachyra vertex*, Lendenfeld 1907*a*, p. 310, pl. xxi, figs. 17–24, pl. xxii, figs. 1–42, pl. xxiii, figs. 1–19: Kirkpatrick 1908*β*, p. 9, pl. x, figs. 1–14: Topsent 1917, p. 33, pl. iii, fig. 5.

Occurrence.—Reg. 1, 2, 20, stn. 331, off McMurdo Sound, 250 faths.: Reg. 3, stn. 355, off McMurdo Sound, 300 faths.: Reg. 4, 18, stn. 316, McMurdo Sound, 190–250 faths.: Reg. 5, 6, 15, 19, stn. 194, off Oates Land, 180–200 faths.: Reg. 7–10, 13–14, stn. 314, McMurdo Sound, 222–241 faths.: Reg. 11, stn. 294, Ross Sea, 158 faths.: Reg. 12, stn. 348, McMurdo Sound, 200 faths.: Reg. 16, 17, stn. 339, off Murdo Sound, 140 faths.

Carter's figures of *Tethya antarctica* and Lendenfeld's of *Cinachyra vertex* suffice to show that the two species are synonymous. Although sigmata were said to be absent in the holotype, the original preparations contain two measuring 0·012 mm. long.

Family HAPLOSCLERIDÆ.

Genus CHALINA, Grant 1861.

The close relationships between *Reniera cinerea* and *Chalina oculata* indicated in my revision of the British species of *Reniera* (1926*β*, p. 422) renders it impossible to separate the two species generically. The Antarctic fauna contains several species of *Reniera* closely allied to *Reniera cinerea* and these, together with the British species, are here transferred to the genus *Chalina*.

Chalina topsenti (Thiele).

Reniera cinerea var. *porosa*, Topsent, 1901δ, p. 12, pl. ii, fig. 2, pl. iii, fig. 2: *R. topsenti*, Thiele 1905, p. 462, figs. 4, 78, 104: *R. kerguelensis*, Hentschel 1914, p. 134, pl. iv, fig. 15, pl. viii, fig. 15: Non *Reniera topsenti*, Dendy 1916, p. 109.

Occurrence.—Reg. 44–47, stn. 220, off Cape Adare, 45–50 fathoms.

Remarks.—*Reniera cinerea* var. *porosa* differs from the typical form of *Reniera cinerea* in the more porous appearance of the surface only. Among my specimens of the latter from the coasts of Britain are some which are practically identical with Topsent's Antarctic variety. Since the species is world-wide in its distribution there is no reason to suppose that the Antarctic forms differ specifically from those of the adjacent waters. For the time being, however, I prefer to regard them as belonging to a distinct species. *Reniera kerguelensis* Hentschel differs in no way from *Reniera cinerea*, so far as I can judge.

Chalina altera (Topsent).

Reniera altera, Topsent 1901, p. 2; Id. 1901δ, p. 13, pl. iii, fig. 12: *R. protelaria*, Topsent 1908, p. 17, pl. iii, fig. 7.

Occurrence.—Reg. 185, stn. 316, McMurdo Sound, 180–250 faths.

Chalina penicillata (Topsent).

Reniera penicillata, Topsent 1908, p. 20, pl. ii, figs. 2, 3, pl. v, fig. 14.

Occurrence.—Reg. 182, 185, stn. 220, off C. Adare, 45–50 faths.

Chalina virens (Topsent).

Reniera virens, Topsent 1908, p. 19, pl. v, fig. 10.

Occurrence.—Reg. 248, stn. 339, off McMurdo Sound, 140 faths.

Chalina dancoi (Topsent).

Reniera dancoi, Topsent 1901, p. 1; Id. 1901δ, p. 12, pl. ii, fig. 1, pl. iii, fig. 3: *Petrosia fistulata*, Kirkpatrick 1907, p. 290: *Reniera scotti*, Id. l.c., p. 291: *Petrosia fistulata*, Id. 1908β, p. 51, pl. xviii, fig. 4, pl. xxiv, fig. 7: *Reniera scotti*, Id. l.c., p. 52, pl. xviii, figs. 1, 2, pl. xxiv, fig. 6: *R. dancoi*, Id. l.c., p. 53, pl. xviii, fig. 3: *R. flaccida*, Topsent 1908, p. 16, pl. iii, fig. 7, pl. v, fig. 7: *R. cylindrica*, Id. 1913*a*, p. 639, pl. ii, fig. 6: *R. dancoi?* Hentschel 1914, p. 134.

Occurrence.—Reg. 134, stn. 339, off McMurdo Sound 140 faths.: Reg. 135, 181, stn. 316, McMurdo Sound, 190–250 faths.

Remarks.—From the twenty odd specimens of tubular Antarctic "*Renieras*" now in the British Museum Collection, it is abundantly clear that the very slight differences between the five so-called species included in the above list of synonyms have little or no taxonomic value. The conuli and mæandrine ridges often found (*e.g. R. scotti*) are evidently correlated with either the age or growth of the sponge since they are most abundantly found in the more mature individuals.

Petrosia fistulata, with its one category of spicules, has little relationship with *Petrosia dura*, the genotype of the genus, in which the skeleton is composed of large and small oxea and strongyla. It appears to be nothing more than an immature form of *Chalina dancoi*.

Cladochalina dendyi, nom. n.

Chalina oculata var. *novæ-zealandiæ*, Dendy 1924, p. 326.

Occurrence.—Reg. 284, stn. 220, off C. Adare, 45–50 faths.

Remarks.—The species resembles the common *Chalina oculata* in external form but is distinguished from it by the possession of a well-defined special dermal skeleton composed of a network of primary and secondary meshes of spiculo-fibre.

Halichondria variabilis (Ridley).

Schmidtia variabilis, Ridley 1884, p. 415, pl. xxxix, fig. N, pl. xli, fig. t: *Petrosia similis*, Ridley and Dendy 1886, p. 327: *P. truncata*, Id. l.c., p. 327: *P. similis*, Id. 1887, p. 9, pl. ii, fig. 10, pl. iii, figs. 3, 4: *P. similis*, var. *massa*, Id. l.c., p. 11, pl. ii, fig. 11, pl. iii, fig. 6: *P. similis*, var. *compacta*, Id. l.c., p. 12, pl. ii, fig. 13, pl. iii, fig. 5: *P. truncata*, Id. l.c., p. 12, pl. ii, fig. 14, pl. iii, fig. 1: *P. variabilis*, Id. l.c., p. 13, pl. ii, fig. 12; Topsent 1901δ, p. 11, pl. ii, fig. 9: *Pellina depellens*, Topsent 1908, p. 15, pl. ii, figs. 1, 5, pl. v, fig. 9: *Reniera tabernacula*, Row 1911, p. 316, fig. 9: *Petrosia depellens*, Topsent 1913*a*, p. 638: *Reniera cribricutis*, Dendy 1921*β*, p. 32, pl. iii, fig. 1, pl. xii, fig. 1: *Halichondria retiderma*, Dendy 1921*β*, p. 38, pl. ii, fig. 5, pl. xii, fig. 7: *Renicra tabernacula*, Burton 1927, p. 74.

Diagnosis.—Sponge polymorphic varying from massive to lobate or sub-ramose; oscules usually large and prominent but varying according to shape of sponge; surface finely reticulate; skeleton confused or regularly reticulate; spongin never present in large quantities but may thinly envelope both primary and secondary lines of skeleton; spicules oxea, sharply- or obtusely-pointed, 0·17 to 0·45 by 0·006 to 0·022 mm.

Remarks.—This species occupies approximately the same position in the Southern Hemisphere that *Halichondria panicea* occupies in the Northern Hemisphere. The British Museum Collection contains a large number of authentic specimens of *Halichondria panicea*, but I have so far been unable to find a single example from the Indian Ocean, South Pacific or Australia, although many have been recorded under this name. This region is, however, inhabited by the present species which, though closely allied, differs markedly from *H. panicea* in many respects, particularly in the more delicate texture of the dermal skeleton. Undoubtedly many more species of so-called Renierinæ will ultimately prove to be synonymous with this one. *Pellina depellens*, excellently described and figured by Topsent, agrees closely with several of the numerous examples of *Halichondria variabilis* at my disposal. *Petrosia variabilis* Topsent (1901δ) appears to be a somewhat macerated fragment of the same species.

Halichondria panicea (Pallas).

This, the typical *Halichondria* species of the Northern Hemisphere, may possibly have penetrated into the Antarctic. It has been recorded by Topsent (1901δ) and some of the specimens, at least, described by Hentschel (1914) may possibly be identical with the Northern forms of the species. Typically a shallow-water sponge, *Halichondria panicea* has been recorded from the Atlantic, the Arctic and Antarctic Oceans. In the British Museum there are hitherto unidentified specimens which show that the

species extends round the Northern coasts of Europe and Asia down to Japan, and round the Northern coasts of Canada to Vancouver. In the South Atlantic it has been recorded by Stephens (1915) from South Africa, while some specimens I have examined from Ancud, Chiloe, differ in no respect from the European forms. There is no record of its existence, however, outside this area. The various forms of *Halichondria panicea* described by Carter, Dendy, and Ridley from various parts of the Indian Ocean really belong to *Trachyopsis*.

Calyx stipitatus, Topsent. (Pl. V, figs. 5, 6.)

C. stipitatus, Topsent 1916, p. 171 ; Id. 1917, p. 81, pl. iv, fig. 13, pl. vi, fig. 24.

Occurrence.—Reg. 235, stn. 356, off McMurdo Sound, 50 faths. : Reg. 236, stn. 331, off McMurdo Sound, 250 faths. : Reg. 237, stn. 294, Ross Sea, 158 faths.

Remarks.—The three specimens differ slightly from the holotype in external form. Two are broadly flabellate and stipitate with the body of the sponge composed of neatly rounded, thin, flattened lobes, while the third consists of flattened branches which tend to expand into laminæ or lobes. The spicules are slightly smaller than those of the holotype, measuring 0·2 to 0·3 mm. long by 0·012 to 0·015 mm. thick. There is a tendency for the exhalent apertures to be grouped on one face of the sponge only.

The " orifices circulaires " (Topsent l.c., p. 81) of the holotype are absent from the " Terra Nova " specimens. Their curious disposition and general appearance suggests that they have been formed by commensal cirripedes and are in no way connected with the canal system of the sponge. Assuming this to be so, their presence or absence has little significance.

Gellius rudis (Topsent).

G. rudis, Topsent 1901, p. 2 ; Id. 1901δ, p. 14, pl. i, fig. 9, pl. iii, fig. 4 ; Id. 1907, p. 77, pl. iii, fig. 2 : *G. fimbriatus*, Kirkpatrick 1907, p. 86 : *G. pilosa*, Id. l.c., p. 86 : *G. rudis*, Id. 1908β, p. 45, pl. xvii, fig. 1, pl. xxiv, fig. 1 : *G. fimbriatus*, Id. l.c., p. 46, pl. xvii, fig. 2, pl. xxiv, fig. 2 : *G. rudis*, Hentschel 1914, p. 287 : *G. tenellus*, Topsent 1916, p. 171 ; Id. 1917, p. 80, pl. vi, fig. 2, 3.

Occurrence.—Reg. 111, stn. 339, off McMurdo Sound, 140 faths. : Reg. 113–230, 289, stn. 356, off McMurdo Sound, 50 faths.

Remarks.—The difference in the appearance of the surface of *Gellius rudis* and *Gellius fimbriatus*, the only point by which the two species might be separated, is simply one of degree. If the skeleton be loosely knit as in the latter the surface is areolated, if compact as in the former the areolation is largely lost. Intermediate forms between the two conditions may be readily found.

The sponge is usually massive or composed of massively cylindrical branches. One specimen combines the two forms, consisting of a broad massive base from which arise a number of stout cylindrical branches which frequently anastomose. The oscules are usually level with the general surface of the sponge, but often the margins may be

carried upwards to form chimney-like vents, or even, in rare cases, the vents may be in the form of Siphonochalina-like tubes, several cms. long.

Gellius tenellus appears to be no more than a form of *Gellius rudis*. In the majority of specimens of *Gellius* the sigmata are present in large quantities. Occasionally, however, they may be only sparingly present. In Reg. 289, which has the external form and general structure of *Gellius rudis*, no trace of sigmata was found.

Gellius bidens, Topsent.

G. bidens, Topsent 1901δ, p. 14, pl. ii, fig. 8, pl. iii, fig. 7.

Occurrence.—Reg. 149, stn. 321, off Inaccessible Island, 180–250 faths.

Gellius phakellioides (Kirkpatrick).

Sigmaxynissa phakellioides, Kirkpatrick 1907, p. 272; Id. 1908β, p. 23, pl. xvii, fig. 6, pl. xxiv, fig. 4: *Gellius flabelliformis*, var. Hentschel 1914, p. 131, pl. viii, fig. 12.

Occurrence.—Reg. 112, stn. 316, McMurdo Sound, 190–250 faths.

Gelliodes benedeni (Topsent).

Gellius benedeni, Topsent 1901, p. 2: *Gelliodes benedeni*, Id. 1901δ, p. 16, pl. ii, fig. 3, pl. iii, fig. 5: *G. benedeni*, var. *fortior*, Id. 1917, p. 75, pl. ii, fig. 1, pl. vi, fig. 22.

Occurrence.—Reg. 108*a–c*, stn. 316, McMurdo Sound, 190–250 faths.

Remarks.—Of the three specimens, two have the same external form as var. *fortior*, the third is sac-shaped like the holotype. The oxea in all three measure 0·5 by 0·024 mm., and the sigmata, 0·039 mm. long. There is no trace of rhaphides.

Assuming that the rhaphides, "pas trés nombreux," in the type of var. *fortior* were foreign, as seems most probable, there appears to be no valid reason for retaining the variety.

Gelliodes spongiosus, Topsent.

G. spongiosus, Topsent 1916, p. 171; Id. 1917, p. 74, pl. vi, fig. 21.

Occurrence.—Reg. 234, stn. 316, McMurdo Sound, 190–250 faths.

Remarks.—Reg. 234 is a large, spherical, much-macerated specimen in which the sigmata range from 0·024 to 0·06 mm. long, and the toxa, fairly constant in size, measure 0·09 mm. long.

Microxina charcoti, Topsent.

M. charcoti, Topsent 1916, p. 170; Id. 1917, p. 72, pl. i, fig. 3, pl. ii, fig. 3, pl. vi, fig. 17.

Occurrence.—Reg. 338, stn. 339, off McMurdo Sound, 140 faths.

Family ISODICTYEÆ.

The Isodictyeæ, as revived by Dendy 1924, may be divided into four groups corresponding to the general *Isodictya* Bowerbank, *Desmacidon* Bowerbank, *Strongylacidon*

Lendenfeld, and *Plumocolumella*, **gen. n.** In addition, *Cercidochela* Kirkpatrick, here regarded as an aberrant form with specialised chelæ, is now included.

Isodictya cactoides (Kirkpatrick).

Desmacidon kerguelensis, var. *cactoides*, Kirkpatrick 1908*β*, p. 38, pl. xix, fig. 2, pl. xxiii, fig. 2.

Occurrence.—Reg. 309–311, stn. 316, McMurdo Sound, 190–250 faths.

Isodictya spinigera (Kirkpatrick).

Desmacidon spinigera, Kirkpatrick 1907, p. 283; Id. 1908*β*, p. 39, pl. xix, fig. 3, pl. xxiii, fig. 3.

Occurrence.—Reg. 107, stn. 339, off McMurdo Sound, 130 faths.

Isodictya verrucosa (Topsent).

Homœodictya verrucosa, Topsent 1913*a*, p. 636.

Occurrence.—Reg. 350, stn. 316, McMurdo Sound, 190–250 faths.

Isodictya kirkpatricki (Topsent).

Homœodictya kirkpatricki, Topsent 1916, p. 170; Id. 1917, p. 70, pl. i, fig. 2, pl. vi, fig. 14.

Occurrence.—Reg. 313, stn. 314, McMurdo Sound, 222–241 faths.: Reg. 314, stn. 339, off McMurdo Sound, 140 faths.: Reg. 315, stn. 331, off McMurdo Sound, 250 faths.

Isodictya cavicornuta, Dendy.

I. cavicornuta, Dendy 1924, p. 335, pl. x, figs. 2–3.

Occurrence.—Reg. 317–318, stn. 316, McMurdo Sound, 190–250 faths.: Reg. 319, stn. 314, McMurdo Sound, 222–241 faths.: Reg. 320–329, 330–332, stn. 194, off Oates Land, 180–200 faths.: Reg. 333, stn. 331, off Cape Bird, 250 faths.

Desmacidon fruticosa (Montagu).

Spongia fruticosa, Montagu 1818, p. 112, pl. xiv, figs. 3, 4: *Desmacidon fruticosa*, Ridley and Dendy 1887, p. 104.

Occurrence.—Reg. 308, stn. 339, off McMurdo Sound, 140 faths.

The present specimen is practically identical with the European forms of the species and the Australian specimen of the "Challenger" Expedition.

Genus PLUMOCOLUMELLA, gen. nov.

Genotype: *Fibulia carnosa*, Carter 1886 (Holotype: Reg. 86.12.15. 372, British Museum Coll.).

Diagnosis.—Isodictyeæ with skeleton composed of bundles of oxea running from centre of sponge to surface, where they end in dermal brushes; fibres formed by these bundles usually slightly curved or even sinuous, often slightly branching and

anastomosing; frequently, by repeated branching and anastomosis, a network is formed with an apparent differentiation into primary and secondary fibres; spongin may or may not be present; microscleres, when present, small isochelæ unguiferæ, to which sigmata may be added; surface of sponge usually marked with a curious pattern due to branching of dermal brushes.

The species which fall more or less naturally into one group and for which this genus was established are :—

P. (*Fibulia*) *carnosa* (Carter).
P. (*Dysidea*) *chaliniformis* (Carter).
P. (*Desmacidon*) *intermedia* (Dendy).
P. (*Desmacidon*) *arenosa* (Whitelegge).
P. (*Desmacidon*) *hispida* (Whitelegge).
P. (*Desmacidon*) *conulissima* (Whitelegge).
P. (*Desmacidon*) *ramosa* (Ridley and Dendy).
P. (*Desmacidon*) *mœandrina* (Kirkpatrick).
P. (*Desmacidon*) *novæ-zealandiæ* (Brøndsted).

Plumocolumella mœandrina (Kirkpatrick).

Desmacidon mœandrina, Kirkpatrick 1907, p. 282; Id. 1908*β*, p. 40, pl. xix, fig. 4, pl. xxiii, fig. 4.

Occurrence.—Reg. 312, stn. 356, off McMurdo Sound, 50 faths.

Plumocolumella cribriporosa, sp. n. (Pl. V, fig. 7.)

Holotype: Reg. 26.10.26. 187, British Museum Coll.

Occurrence.—Reg. 187, stn. 356, off McMurdo Sound, 50 faths.: Reg. 188, stn. 338, off McMurdo Sound, 207 faths.

Diagnosis.—Sponge composed of several cylindrical, more or less erect, branches arising from a stolon-like basal portion; surface smooth, marked by numerous circular pore areas; oscules few, chimney-like; spicules, oxea only.

Remarks.—The pore areas, so abundantly scattered over the whole surface of the sponge, are usually circular in outline and range from 1 to 1·5 mm. in diameter. In each case, the margin is slightly raised above the level of the general surface. Stretched across the circular pit so formed is a delicate pore-bearing membrane. The pores, which are only just visible when viewed with a hand lens, open into a sub-dermal cavity lying beneath the pore-bearing membrane.

A collenchymatous ectosome, about 0·2 mm. thick, is present.

The skeleton consists of abundant oxea, 0·48 by 0·012 mm., arranged in dense radially-arranged wisps running from the centre of the branch to the surface, where the ends of the outermost spicules project slightly beyond the ectosome. There are no chelæ but the general structure of the sponge, particularly of its skeleton, suggests a

strong affinity between it and those species for which the genus *Plumocolumella* is established.

A few oval embryos, 0·18 by 0·15 mm. are present.

Cercidochela lankesteri, Kirkpatrick. (Pl. V, fig. 8.)

C. lankesteri, Kirkpatrick 1907, p. 284; Id. 1908*β*, p. 42, pl. xix, fig. 5, pl. xxiii, fig. 5; Hentschel 1914, p. 74.

Occurrence.—Reg. 151, stn. 314, McMurdo Sound, 222–241 faths.: Reg. 179, stn. 294, Ross Sea, 158 faths.: Reg. 180, stn. 356, off McMurdo Sound, 50 faths.

Remarks.—The only specimens hitherto recorded have been young, but the present examples are apparently fully-grown flabello-digitate or flabellate sponges. The total height of the figured specimen is 20 cms., the breadth 10 cms. and the thickness of the frond 1·3 cms. The stout stalk, 8 cms. long by 1 cm. in diameter, bears the remains of rooting processes.

The exhalant apertures are not simple as in the holotype but consist of comparatively deep, cavernous pseudoscula receiving the openings of the exhalant canals whose margins are invariably raised above the surface to a height of 3 to 4 mm. They are confined to one side of the sponge.

Section GUITARREÆ.

Guitarra fimbriata, Carter.

G. fimbriata, Carter 1874, p. 4, pl. xiii, figs. 2–5, pl. xv, fig. 34; Schmidt 1880, p. 84, pl. ix, fig. 7: *G. voluta*, Topsent 1904*a*, p. 209, pl. v, figs. 13, 14, pl. xvi, fig. 9: *G. antarctica*, Hentschel 1914, p. 75, pl. vi, fig. 4: *G. indica*, Dendy 1916, p. 124, pl. i, fig. 5, pl. iii, fig. 21: *G. sigmatifera*, Topsent 1916, p. 170; Id. 1917, p. 71, pl. i, fig. 6, pl. vi, fig. 16: *G. antarctica*, var. *novæ-zealandiæ*, Dendy 1924, p. 336: *G. bipocillifera*, Brøndsted 1924, p. 458, fig. 16.

Diagnosis of species.—Sponge cushion-shaped; skeleton a more or less regular reticulation of tornota; no special dermal skeleton; tornota measure 0·266–0·735 by 0·006–0·017 mm., and are variable in form, with one end usually oxeote, mucronate, stylote or strongylote while the other is invariably exeote; microscleres, fimbriated placochelæ, showing a tendency to differentiation into two categories, measuring 0·03–0·14 mm. long, and minute bipocilli of peculiar form, 0·008–0·028 mm. long.

Remarks.—Brøndsted (l.c.) called attention to some curious, minute microscleres which looked, at first sight, like sigmata but which proved to be a form of bipocillum. He further suggested that "the sigmata of some of the other described *Guitarra*-species will prove to be of the same nature." I have found this to be a fact in every specimen examined, although in every case their precise character had been misinterpreted by the authors describing them. Further, as the result of the examination of a considerable quantity of material, including many type-specimens, it seems extremely probable

that the six species hitherto described are no more than simple variations of a single species.

All agree closely in external form, the arrangement of the skeleton and the shape of the spicules, and their only differences concern the dimensions of the spicules. These are set forth in the following table :—

Species.	Placochelæ.		Bipocilla.	Tornostrongyla.
	Large.	Small.		
fimbriata	0·09–0·1 *	0·04–0·05 *	0·01–0·011 *	0·31 × 0·005 *
voluta, spec. 1	0·12–0·14	0·067–0·07	0·013–0·015 †	0·6–0·735 × 0·013–0·015
„ „ 2	0·08	?	0·013–0·015 †	0·54 × 0·009
antarctica	0·095–0·11	0·044–0·055	0·023–0·028	0·408–0·496 × 0·007–0·011
indica	0·041	?	0·01 *	0·266 × 0·007
sigmatifera	0·087–0·095	?	0·01–0·011	0·57–0·68 × 0·015–0·017
antarctica, var. *novæ-zealandiæ*	0·04	?	0·01	0·3 × 0·006
bipocillifera	0·1	0·4	0·01–0·014	0·45 × 0·009

The first thing to be noticed in this table is that *G. antarctica* and *bipocillifera* are practically identical except for the size of the bipocilla; but since those of the former are less curved than those of the latter, and their length in a straight line correspondingly greater, the difference is clearly unimportant. These two species, moreover, differ from the genotype only in the slightly larger size of the tornostrongyla, and from *sigmatifera* in that these same spicules are slightly smaller. For the rest, *indica* is indistinguishable from *antarctica* var. *novæ-zealandiæ*, while the holotype of *voluta* differs from all other species by the large size of all its spicules. We are left, therefore, with three "species," *fimbriata*, with its synonyms *antarctica*, *sigmatifera* and *bipocillifera*; *indica*, with its synonym *antarctica* var. *novæ-zealandiæ*; and *voluta*. The only differences between them are that the spicules of the first are slightly larger than the second but smaller than those of the third. Since the two specimens described by Topsent under *voluta*, specimens coming from exactly the same locality, differ as much from each other as the three so-called species differ among themselves, it does not seem reasonable to regard the mere difference in the dimensions of spicules as of taxonomic significance.

It must be admitted that to regard two specimens, one with placochelæ 0·04 mm.

* From measurements taken from the types.

† Topsent 1917, p. 72.

? The authors have failed to give measurements of the small placochelæ, regarding them, no doubt, as young forms of the larger. In two cases, *indica* and *antarctica* var. *novæ-zealandiæ*, I have seen by re-examination of the types that they are really present, and assume, therefore, that the same holds true for the others.

long and the other with placochelæ 0·14 mm. long, as members of the same species is to allow a greater range in variation in the spicules of a single species than is usually the case. Nevertheless, in addition to the disparity in the size of the spicules of Topsent's two specimens from the same locality, to which reference has already been made, we find that *G. bipocillifera* and *G. antarctica* var. *novæ-zealandiæ*, from almost identical localities, have placochelæ measuring 0·1 and 0·04 mm. long respectively. The only conclusion seems to be, therefore, that *G. fimbriata* is a species extending from the Northern Atlantic to the Indian Ocean, New Zealand and the Antarctic, in which the size of the spicules, especially of the placochelæ, is more variable than is usual in species of sponges while all other features are more or less constant.

Section MYCALEÆ.

The various species at present included in the genus *Esperiopsis* may be divided into four homogeneous groups corresponding to four genera :—

Esperiopsis, Carter 1874, p. 7 : genotype, *E. villosa*.

Diagnosis.—Mycaleæ with main skeleton composed of plumose columns of large subtylostyli running vertically to the surface ; microscleres including three categories of isochelæ, except where absent by reduction, and two of sigmata. No special dermal skeleton.

Amphilectus, Vosmaer 1880, p. 109 : genotype, *Isodictya gracilis*, Bowerbank.

Diagnosis.—Mycaleæ with a reticulate skeleton of short styli ; microscleres of one form only, small palmate isochelæ. No special dermal skeleton.

Remarks.—The genus *Amphilectus* has been badly used in the past and has served as a receptacle for all the aberrant Mycaleæ and some reduced Ectyoninæ whose relations were not properly understood. The genotype is an undoubted synonym of *Isodictya fucorum* (Johnston) Bowerbank, and the genus must include the numerous species of *Esperiopsis*, so-called, conforming to that type.

Corybas, Gray 1867, p. 527 : genotype, *Spongia lobata* Montagu (= *Isodictya lobata* Bowerbank).

Diagnosis.—Mycaleæ with a reticulate skeleton of short styli ; microscleres of one form only, small palmate anisochelæ. No special dermal skeleton.

There is only one species, a sponge of rare occurrence on the British Coasts.

Brondstedia, **gen. nov.** : genotype, *Esperiopsis glaber*, Brøndsted.

Diagnosis.—Mycaleæ with a reticulate skeleton of short styli and with a special dermal layer of tangentially-arranged styli differing in no respect from the styli of the main skeleton ; microscleres, small palmate isochelæ to which sigmata may be added.

Esperiopsis villosa (Carter).

Esperia villosa, Carter 1874, p. 7, pl. xiii, figs. 13–15, pl. xv, fig. 36: *Esperiopsis villosa*, Carter 1882, p. 296: *Esperia villosa*, Fristedt 1887*a*, p. 451, pl. xxv, figs. 33–38, pl. xxix, fig. 19: *Desmacidon bosei*, Noll 1888, p. 6, pl. i: *Esperiopsis prædita*, Topsent 1892, p. 92, pl. x, fig. 4: *E. villosa*, Id. 1904, p. 211, pl. xviii, fig. 2: *E. decora*, Id. l.c., p. 212, pl. lxxxviii, fig. 8: *E. prædita*, Id. l.c., p. 212: *E. villosa*, Lundbeck 1905, p. 9, pl. i, fig. 4, pl. viii, fig. 1: *E. flagellum*, Id. l.c., p. 20, pl. ix, fig. 1: *E. villosa*, Kirkpatrick 1908*β*, p. 35, pl. xx, fig. 3, pl. xxiv, fig. 9: *E. incognita*, Stephens 1921, p. 18, pl. ii, fig. 3: *E. macrosigma*, Id. l.c., p. 19, pl. ii, fig. 4: *E. macrosigma*, var. *novæ-zealandiæ*, Dendy 1924, p. 341, pl. xiii, figs. 14–20: *E. megachela*, Dendy 1924, p. 341, pl. xiii, figs. 21–25.

Remarks.—The species and varieties included above as synonyms of *Esperiopsis villosa*, Carter, may be divided into three groups: (*a*) with three categories of isochelæ of which the larger are the so-called placochelæ (*i.e.* those of the typical *E. villosa*-type); (*b*) with three categories of isochelæ in which the larger differ slightly in form from the so-called placochelæ; (*c*) with two categories of isochelæ.

Group (*a*) includes *E. villosa*, Carter (Faröe Is.), Topsent (Azores), Lundbeck (Greenland), and *Desmacidon bosei* Noll (an obvious synonym of *E. villosa*, from Norway). Group (*c*) includes *E. prædita* Topsent (Azores), *E. flagellum* Lundbeck (Greenland), *E. decora* Topsent (Azores), *E. incognita* Stephens (Irish Seas) and *E. villosa* Kirkpatrick (Antarctic). The only differences between the sponges of these two groups, apart from the minor differences in spicule size, which may very well be ignored, are that the so-called placochelæ are absent in the second group. On the other hand, the two groups resemble each other very strongly in all other respects. Considering the similarity of the geographical distribution, if we exclude for the moment Kirkpatrick's Antarctic specimen, the only view to take is that group (*c*) consists of forms identical with those of group (*a*) except that they have lost the larger chelæ.

Group (*b*) includes *E. macrosigma* Stephens (Irish Seas) *E. macrosigma* var. *novæ-zealandiæ* Dendy and *E. megachela* Dendy (New Zealand). These three differ from the typical form of *E. villosa* (group (*a*)) in one respect only, that the larger chelæ are somewhat broader, and, although very similar to them in appearance, are no longer called placochelæ.

Since all the species and varieties of these three groups are almost identical in habitat, external form and spiculation (except for the presence or absence of the larger chelæ or for slight differences in shape) I can see no alternative to regarding them all as synonyms of one and the same species.

Admitting this view to be correct, we ascribe to the larger chelæ of *E. villosa*, as here understood, a range of variation in form which is no greater than that demonstrated in the various species of *Mycale*, an allied genus, by Topsent in 1924*a*.

E. decora Topsent is, however, unlike the rest in that it possesses small trichodragmata in addition to the chelæ and sigmata. Trichodragmata of this type are problematic bodies. I have found isolated trichodragmata in several species of sponges which ordinarily do not possess them but their occurrence is so sporadic that they

cannot be regarded as of systematic importance unless it can be proved that their occurrence is constant for the species as a whole.

Curiously enough, I have found a few isolated trichodragmata in the holotype of *E. villosa* so that I am even more inclined to regard their presence in *E. decora* as of no systematic importance.

Amphilectus rugosa, Thiele, var. *major* (Hentschel).

Esperiopsis rugosa, Thiele, var. *major*, Hentschel 1914, p. 68.

Remarks.—There is a strong possibility that *E. rugosa* may be synonymous with *E. edwardii* var. *americana* (Ridley and Dendy), a species closely allied to *E. edwardii* but localised on the Southern shores of South America. Since the differences between the var. *major* and the typical form of *E. rugosa* are so slight as to be almost negligible, the species affords a link between the S. American and Antarctic faunas.

Mycale acerata, Kirkpatrick.

M. acerata, Kirkpatrick 1907, p. 280; Id. 1908*β*, p. 36, pl. xx, fig. 1, pl. xxiv, fig. 10: *M. acerata*, var. *minor*, Hentschel 1914, p. 63: *M. acerata*, Topsent 1917, p. 63.

Occurrence.—Reg. 150, stn. 339, off McMurdo Sound, 140 faths.

Remarks.—Re-examination of the holotype has shown that the average size of the megascleres is about 0·6 by 0·012 mm. In the third of the "Discovery" specimens the average is 0·48 by 0·012 mm. Further, although Kirkpatrick (1908*β*) mentions only two categories of anisochelæ, a third is present whose average length is 0·025 mm. It is clear therefore that Hentschel's var. *minor* is much more like the typical form than that author suspected.

Mycale pellita, Topsent.

M. sp., Kirkpatrick 1908*β*, p. 37: *M. pellita*, Topsent 1913*a*, p. 633, pl. v, fig. 2.

Remarks.—Topsent described this species as "voisine d'une *Mycale* sp. de l'Antarctique signalée par Kirkpatrick." I have re-examined the *Mycale sp.* referred to (Kirkpatrick l.c.) and find it a typical example of *M. pellita*. Kirkpatrick's measurements are those of the maximum size and, in addition, the second category of chelæ is present but in very small quantities.

Mycale tridens, Hentschel.

M. tridens, Hentschel 1914, p. 56, pl. v, fig. 6; Topsent 1917, p. 63.

Occurrence.—Reg. 93, stn. 314, McMurdo Sound, 222–241 faths.

Remarks.—The only representative is a large, massive sponge, whose surface is thrown into low rounded tubercles, or plateaux, separated by deep meandering grooves. The oscules are trumpet-shaped, very like those of *Inflatella belli*, about 1 cm. high.

The appearance of the sponge, apart from the oscules, recalls the external form of *M. lingua*, so that although it has not been possible to study satisfactorily the character of the dermal skeleton it is probable that the species belongs to the sub-genus *Mycale*.

Desmacella vestibularis (Wilson).

Tylodesma vestibularis, Wilson 1904, p. 139, pl. xviii, figs. 8–9, pl. xix, fig. 1, pl. xxii, fig. 4, pl. xxiii, figs. 1–3 : *Desmacella vestibularis*, Dendy 1924, p. 345.

Occurrence.—On *Stelletta crater*, Reg. 250, stn. 339, off McMurdo Sound, 140 faths.

Artemisina apollinis (Ridley and Dendy).

Amphilectus apollinis, Ridley and Dendy 1886, p. 350; Id. 1887, p. 125, pl. xix, fig. 10, pl. xxv, fig. 2 : *Artemisina apollinis*, Kirkpatrick 1908β, p. 34, pl. xx, fig. 4 : *A. dianæ*, Topsent 1907, p. 22, pl. iii, fig. 4, fig. pl. v, fig. 1 ; Hentschel 1914, p. 70.
(For further synonymy see Kirkpatrick l.c.)

I have here adopted the suggestion, made by both Kirkpatrick (l.c.) and Hentschel (l.c.), that *A. dianæ* is only a form of *A. apollinis*.

Artemisina plumosa, Hentschel.

A. plumosa, Hentschel 1914, p. 70, pl. iv, fig. 5, pl. vi, fig. 1 : *A. plumosa*, var. *lipochela*, Id. l.c., p. 72 : *A. strongyla*, Id. l.c., p. 72, pl. vi, fig. 2.

Remarks.—*A. plumosa*, with its variety *lipochela*, and *A. strongyla* form a well-defined group, sufficiently alike to be regarded as a single species, readily distinguishable from the only other Antarctic species of the genus, *A. apollinis*. When, in a sponge, some of the styli are modified to strongyla, the modification is very frequently accompanied by the appearance of siliceous spheres, and, since the phenomenon is so familiar, it is not worth while emphasising the fact by the erection of a distinct species for the specimen in which it occurs. *A. strongyla* is such a sponge, which has so much in common with *A. plumosa* that I do not see how they may be reasonably separated.

Chondrocladia clavata, Ridley and Dendy.

C. clavata, Ridley and Dendy 1886, p. 345 ; Id. 1887, p. 100, pl. xx, fig. 1, pl. xxi, fig. 11.

Occurrence.—Reg. 152, 153, stn. 316, McMurdo Sound, 190–250 faths. : Reg. 154, stn. 314, McMurdo Sound, 222–241 faths.

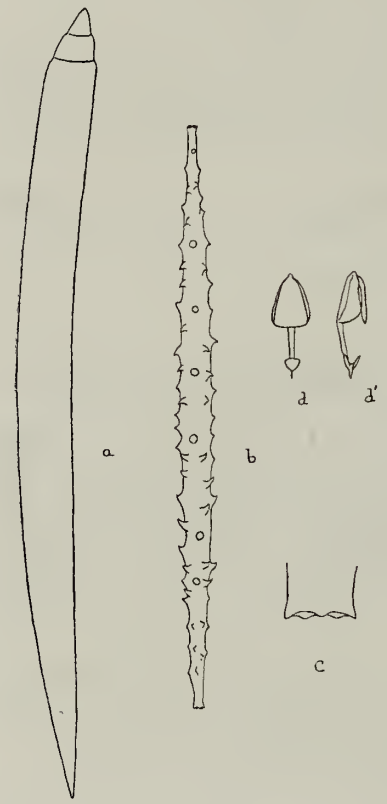
Remarks.—The largest of the three specimens present is 8 cms. high, including the stalk, and the diameter of the head is 2 cms. The surface of the head bears numerous long processes. In the other two, the processes are represented by numerous low conules. The following are the measurements of the spicules : styli, 1·26 by 0·024 mm. ; larger chelæ, 0·048 mm., smaller chelæ, 0·024 mm. long ; sigmata, 0·045 mm. long. In one specimen, some of the styli attained a length of over 2 mm. but this was the only respect in which the three sponges differ from the holotype.

ACANTHORHABDUS, gen. nov.

Genotype : *Acanthorhabdus fragilis*, sp. n.

Diagnosis.—Mycaleæ whose principal megasclere is a modified style (always ?) arranged in a coarse but ill-defined reticulation ; accessory megascleres, acanthorhabds, are present forming a loose tangential dermal layer, and scattered between fibres of main skeleton, occasionally actually associated with them ; microscleres, anisochelæ.

Remarks.—The principal spicule of this genus is really a modified style, although, at first sight, it appears to be an oxeote. This and the fact that the microsclere is an anisochela has suggested that the correct position for the genus is with the Mycaleæ, of which group it is a somewhat aberrant member.



TEXT-FIG. 5.—*Acanthorhabdus fragilis*, sp. n. *a*. Modified style of the main skeleton, × 250; *b*. Acanthorhabd, × 250; *c*. End of an acanthorhabd, × 600; *d*, *d'*. Anisochelae, front and side views, × 600.

Acanthorhabdus fragilis, sp. n. (Pl. IV, fig. 2; text-fig. 5.)

Holotype.—Reg. 26.10.26. 189, British Museum Coll.

Occurrence.—Reg. 189–196, stn. 314, McMurdo Sound, 222–241 faths. : Reg. 197, stn. 220, off C. Adare, 45–50 faths.

Diagnosis. — Sponge sub-spherical or regularly massive ; surface minutely conulose ; texture friable ; oscules, on level with general surface or raised on small papillæ ; pores scattered generally over surface ; colour, in spirit, green to greenish-yellow. Spicules, modified styli, acanthorhabds and anisochelæ.

Remarks.—The specimens are extremely friable and have lost nearly all trace of the ectodermal tissues. For that reason, fig. 2, pl. IV, is inadequate for depicting the characters of the surface. These have to be reconstructed from the portions of the ectoderm remaining intact.

The main skeleton is a coarse reticulation of bundles of principal megascleres, the bundles being 12 spicules thick.

Spicules.—(1) *Styli* (fig. 5 *a*). These are of peculiar form and resemble oxea in appearance. Indeed, in the young stages there appears to be nothing to distinguish them from oxea. However, the fact that one end of the spicule is distorted in the adult stage, makes it probable that they are modified styli rather than oxea. Size of spicule 0·408 mm. by 0·024 mm.

(2) *Acanthorhabds* (fig. 5 *b*), fusiform, truncated at each end, strongly spined

throughout the whole length of the spicule and with a short terminal crown of spines at each end, 0·3 by 0·014 mm.

(3) *Anisochelæ* (fig. 5 *c*), 0·02 mm. long.

Chondropsis chaliniformis (Carter).

> *Dysidea chaliniformis*, Carter 1886, p. 217: *Phoriospongia chaliniformis*, Lendenfeld 1889, p. 600, pl. xxxvii, fig. 8, pl. xl, figs. 1, 2, pl. xli, fig. 2.

Occurrence.—Reg. 287, stn. 339, off McMurdo Sound, 140 faths.

Remarks.—The larger of the two specimens consists of a single branch, 14 cms. in length and 0·7 cm. in diameter, with the oscules arranged in a linear series along one side. The internal structure agrees so closely with that of the holotype, given by Lendenfeld (1889, p. 600), that there can be no doubt as to the identification of the Antarctic form with those from Australia. The dimensions of the spicules, however, are more nearly those given by Dendy (1895, p. 253) than those of the holotype, viz. strongyla, 0·13 by 0·004 mm., sigmata, from 0·015 to 0·03 mm. in length.

Chondropsis ceratosus Kirkpatrick, from Funafuti, appears to be a chalinopsilloid *Gelliodes* rather than a *Chondropsis*, in which the structure of the fibres resembles that of the typical *Gelliodes*. The megascleres are oxea and the sigmata are much more those of a typical *Gellius* than of a *Phoriospongia*.

Section CLATHRIÆ.

Axociella nidificata (Kirkpatrick).

> *Ophlitaspongia nidificata*, Kirkpatrick 1907, p. 274: Id. 1908β, p. 25, pl. xxii, fig. 6, pl. xxvi, fig. 5.

Occurrence.—Reg. 84, stn. 316, McMurdo Sound, 190–250 faths.: Reg. 85, stn. 314, McMurdo Sound, 222–241 faths.: Reg. 86, stn. 355, off McMurdo Sound, 300 faths.: Reg. 87, stn. 331, McMurdo Sound, 250 faths.

Axociella flabellata (Topsent).

> *Ophlitaspongia flabellata*, Topsent 1917, p. 41, pl. i, fig. 4, pl. vi, fig. 2.

Occurrence.—Reg. 199, stn. 294, Ross Sea, 158 faths.

Remarks.—The present example, although quite typical in regard to the spiculation, differs a little from the holotype in external form. Instead of the simple lamina it consists of a number of cylindrical or flattened branches which anastomose to form small secondary laminæ.

PSEUDANCHINOË, gen. nov.

Genotype: *Stylostichon toxiferum*, Topsent.

Diagnosis.—Clathriæ with skeleton composed of vertical bundles of basally-spined styli echinated throughout their length by entirely spined acanthostyles set more or

less at right angles to them ; microscleres, palmate isochelæ and toxa ; there is a special dermal skeleton of basally spined subtylostyles.

Remarks.—The similarity between *Stylostichon toxiferum* and the typical species of *Anchinoë* is due to convergence and not to a direct relationship. *Anchinoë* possesses vertical columns of tornota, a spicule characteristic of the Myxilleæ, while the present genus has similar columns composed of basally-spined styli and dermal subtylostyles which are characteristic of the Clathriæ.

Pseudanchinoë toxiferum (Topsent).

Stylostichon toxiferum, Topsent 1913*a*, p. 621, pl. iv, fig. 7, pl. vi, fig. 14 : *Anchinoë toxiferum*, subsp. *antarctica*, Topsent 1917, p. 43, pl. iv, fig. 5, pl. vi, fig. 5.

Occurrence.—Reg. 242, stn. 314, McMurdo Sound, 222–241 faths.

Remarks.—The present example of the species is intermediate in form between the holotype and the type of the subspecies. It is a brownish massive sponge about 3 cms. by 3 cms. by 2 cms. and bears on its upper surface a few mammiform processes. In spiculation it is also to some extent intermediate, the few characteristic features present being sufficient to show that the species is a variable one but are not of sufficient interest to justify their being recorded here. Since Topsent (1917) founded his subspecies on these small differences in spiculation, and since the species is now known to be more variable than at first appeared, it is no longer necessary to recognise the subspecies.

Section HYMEDESMIEÆ.

Genus HYMEDESMIA, Bowerbank 1864.

Suberotelites, Schmidt 1868, p. 12 ; *Stylopus*, Fristedt 1885, p. 28 : *Leptosia*, Topsent 1892*a*, p. xxii : *Hymenancora*, Lundbeck 1910, p. 116.

The supposed distinction between the chelæ of *Hymedesmia* and *Hymenancora* is inadequate for the purpose of generic distinction (cf. Dendy 1921β, p. 81) and the two genera are here regarded as synonymous. Again, *Stylopus* is identical with *Hymedesmia* except for the absence of chelæ and, in view of the ease with which whole categories of microscleres may be lost, it is not possible to make this feature one of generic importance. A preparation of the type of Schmidt's *Suberotelites mercator*, in the British Museum Collection, shows the species to be a typical *Hymedesmia*.

Hymedesmia unguifera, **sp. n.** (Text-fig. 6.)

Holotype.—Reg. 26.10.26. 233, British Museum Coll.

Occurrence.—Reg. 233, stn. 356, McMurdo Sound, 50 faths.

Diagnosis.—Sponge forming a thin incrustation on a small branching alga : skeleton of usual form consisting of acanthostyles, incompletely divided into two categories, dermal tylota, and two sorts of chelæ.

Spicules.—(1) *Large acanthostyles* (fig. 6 *a*), sparingly spined in the basal portion only, 0·54 by 0·013 mm.

(2) *Small acanthostyles* (fig. 6 *b*), spined throughout with distinct globular head bearing strongly developed spines. Length of spicule, 0·162 by 0·009 mm.

(3) *Tornota* (fig. 6 *c*), smooth, asymmetrically-ended, slightly dilated at each end into a small head, 0·235 by 0·008 mm.

(4) *Isochelæ arcuatæ* (fig. 6 *e*), 0·024 mm. long.

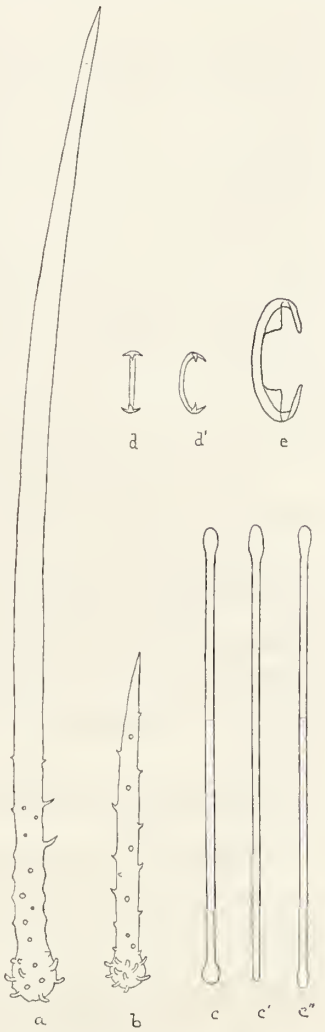
(5) *Isochelæ unguiferæ* (fig. 6 *d*), with three distinct teeth, two directed laterally and the third directed forwards, 0·012 mm. long.

Remarks.—The distinctive feature of this species is the presence of the chelæ unguiferæ.

Rhabderemia coralloides, Dendy.

R. coralloides, Dendy 1924, p. 357, pl. xii, fig. 3, pl. xv, figs. 1–4.

Occurrence.—Reg. 92, stn. 339, off McMurdo Sound, 140 faths.



Text-fig. 6.—*Hymedesmia unguifera* sp. n. (*a*) Large basally-spined acanthostyle, × 250; (*b*) Small entirely-spined acanthostyle, × 250; (*c*, *c'*, *c''*) Tornota, × 250; (*d*, *d'*) Isochelæ unguiferæ, front and side views, × 600; (*e*) Palmate isochela, × 600.

Section PLOCAMIÆ.

Plocamia gaussiana, Hentschel.

P. gaussiana, Hentschel 1914, p. 120, pl. viii, fig. 5.

Occurrence.—Reg. 90, stn. 316, McMurdo Sound, 190–250 faths.: Reg. 91, stn. 194, off Oates Land, 180–200 faths.

Family MYXILLEÆ.

Genus MYXILLA, Schmidt.

Dendoryx, Gray 1867, p. 535: *Emplocus*, Gray 1867, p. 535; *Tereus*, Gray 1867, p. 537; *Hastatus*, Vosmaer 1880, p. 136.

Myxilla elongata, Topsent.

M. elongata, Topsent 1917, p. 54, pl. iv, fig. 3, pl. vi, fig. 11.

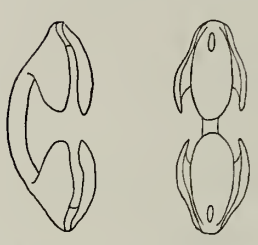
Occurrence.—Reg. 116, stn. 316, McMurdo Sound, 190–250 faths.: Reg. 216–231, stn. 314, McMurdo Sound, 222–241 faths.

Lissodendoryx flabellata, **sp. n.** (Pl. IV, fig. 3, text-fig. 7.)

Holotype.—26.10.26. 232; British Museum Coll.

Occurrence.—R.N. 232, stn. 314, McMurdo Sound, 222–224 faths.

Diagnosis.—Sponge flabellate, erect; surface irregular, uneven, minutely conulose; oscules not apparent; pores probably evenly distributed; colour, in spirit, grey externally, pink internally; spicules, smooth styli, tornota and chelæ arcuatæ.



TEXT-FIG. 7.—*Lissodendoryx flabellata*, sp. n. Isochelæ, front and side views, × 1,200.

Remarks.—The main skeleton is an irregular reticulation of bundles of smooth styli, the bundles containing from six to twenty spicules. There is the usual dermal skeleton of tornota while the dermal membrane, and to a lesser extent, the choanosome are crowded with numerous chelæ arcuateæ.

Spicules.—(1) *Styli* of the main skeleton, smooth, gently curved near the base, 0·45 by 0·016 mm.

(2) *Tornota* smooth, straight, with a mucron at each end, 0·36 by 0·005 mm.

(3) *Isochelæ arcuatæ* (fig. 7), varying slightly in size but measuring, on the average, about 0·021 mm. in length. The teeth and alæ are nearly equal in length, about 0·008 mm. in a typical example, and both show a tendency to curve in towards the shaft.

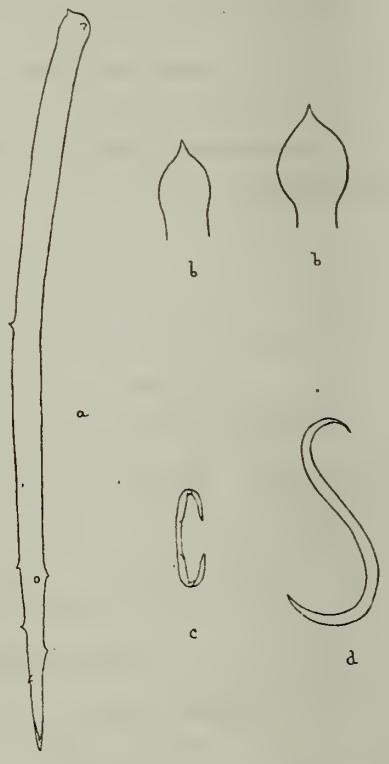
Lissodendoryx innominata, **sp. n.** (Text-fig. 8.)

Holotype.—Reg. 26.10.26. 244, British Museum Coll.

Occurrence.—Reg. 244, stn. 344, off C. Royds, 200 faths.

Diagnosis.—Sponge pyriform; surface uneven; oscules not apparent; pores probably evenly distributed over general surface; colour, in spirit, greyish-yellow; spicules, acanthostyles, tornota, chelæ arcuatæ, sigmata and trichodragmata (?).

Remarks.—The skeleton is of the usual type, consisting of a stout reticulation of styli with dermal brushes of tornota. The microscleres consist of isochelæ, arcuatæ and sigmata.



TEXT-FIG. 8.—*Lissodendoryx innominata* sp. n. (*a*) Acanthostyle of the main skeleton, × 250; (*b*) Ends of tornota, × 1000; (*c*) Isochela, × 600; (*d*) Sigma, × 600.

Spicules.—(1) *Styli* (fig. 8 *a*), usually smooth for the greater part of their length and sparingly spined in the distal part, but spination varies a great deal; with a slight tendency to become subtylostylote at the base, usually slightly curved, measuring 0·372 by 0·012 mm.

(2) *Tornota* (fig. 8 *b*), smooth, equi-ended, with sharply-pointed, mucronate or hastate ends, 0·28 by 0·006 mm.

(3) *Isochelæ arcuatæ* (fig. 8 *c*), of very rare occurrence, 0·021 mm. long.

(4) *Sigmata* (fig. 8 *d*), of the usual form, 0·045 mm. long.

Both forms of microsclere are extremely rare but sufficiently constant and evenly distributed to be regarded without doubt as a normal constituent of the spiculation.

(5) *Trichodragmata* (??). In certain parts the choanosome of this sponge is charged with a number of trichodragmata-like bodies which occur singly or in bundles and measure 0·012 mm. in length. Their appearance and distribution is different in an almost indefinable way from trichodragmata proper, so that one is led to the belief that they are not spicules, *sensu stricto*, but something which does not belong to the normal spiculation of the species. For one thing, they are not so refractive as the customary trichodragmata and give the impression of being rather a crystalline waste product than a siliceous spicule. Under *Esperiopsis villosa* I have suggested the possibility that the so-called trichodragmata of *E. decora* Topsent may be of the same nature.

The choanosome contains a large number of spherical eggs, 0·3 mm. in diameter, in various stages of segmentation.

This species is rather unsatisfactory in that the holotype is not in a good state of preservation and that there are no distinctive features by which it might be readily recognised. It is different, however, from any known species of *Lissodendoryx* in numerous details of the spiculation.

Genus ECTYOMYXILLA, Lundbeck.

Crellomyxilla, Dendy 1924, p. 363.

Ectyomyxilla kerguelensis, Hentschel.

E. kerguelensis, Hentschel 1914, p. 103, pl. iv, fig. 10, pl. vii, fig. 10: *Crellomyxilla intermedia*, Dendy 1924, p. 364, pl. xv, figs. 16–21: *Myxilla tornotata*, Brøndsted 1923, p. 142, fig. 21.

Occurrence.—Reg. 94, 95, stn. 339, McMurdo Sound, 140 faths.

Remarks.—The two specimens differ in external form and slight details of spiculation from both the "Gauss" and the New Zealand forms. They are both flabellate with distinct poral and oscular surfaces. The oscular surface is concave with one or two irregular ridge-like projections from the surface so that the sponge comes to resemble the human ear more than any other common object. They are, therefore, intermediate in character between the "Gauss" specimens, which were massive, and the New Zealand forms, which were flabellate or branching. The oscules are evenly distributed over the concave face of the sponge and rarely exceed 1 mm. in diameter. The colour, in spirit, is white.

The measurements of the spicules for both specimens are as follows : Larger acanthostyles, maximum length 0·15 mm. ; smaller acanthostyles, maximum length 0·12 mm. ; tornota, usually 0·13 mm. long ; sigmata, maximum length 0·036 mm. ; chelæ, varying considerably, from 0·12 to 0·033 mm. long.

The only difference between the present specimens and those described by Hentschel rests in a slight difference in external form, small differences in the dimensions of the spicules and the shape of the chelæ. According to Hentschel, these latter measure 0·0125 to 0·019 mm. in length, while the teeth are a quarter the length of the whole spicule. In my specimens they are from 0·012 to 0·033 mm. in length and the teeth are a third the length of the whole spicule. As to the first point, the larger chelæ are not abundant and it is just possible that in Hentschel's specimens they were even less abundant. Dendy speaks of the chelæ of his specimen as being divided into two categories and of the larger chelæ as "not very numerous." A curious feature of these spicules is that when seen in profile they appear to have teeth one-third the length of the whole spicule. From the front, however, they appear to be only one quarter of the total length. This probably accounts for the discrepancy between the measurements of the chelæ of the "Gauss" and "Terra Nova" specimens. Re-examination of the holotype of *Crellomyxilla intermedia* shows that there are not two categories of chelæ as Dendy suggests, and that the two sizes of this spicule merge insensibly into each other. Further, there is no possible doubt that his specimens and the present specimens belong to the same species.

Myxilla tornotata Brøndsted (1923) also appears to be a synonym of the present species. Although Brøndsted places all the acanthostyles in a single category, his figures give the impression that they are probably divisible into two, as in the other specimens regarded here as belonging to *Ectyomyxilla kerguelensis*.

Ectyomyxilla hentscheli, **nom. n.**

Myxilla spongiosa, Hentschel 1914, p. 97, pl. vii, fig. 5.

The holotype of *Myxilla spongiosa* Ridley and Dendy possesses but one category of stylote megascleres while the specimens described by Hentschel (l.c.) contain echinating acanthostyles in addition. Since the latter do not belong to any known species, I propose the above new species for their reception.

Genus MYXODORYX, **gen. nov.**

According to Topsent (1900, p. 258), the genotype of *Lissomyxilla* Hanitsch, *L. spinosa*, belongs to the genus *Tethyspira*. *Lissomyxilla* is therefore a synonym of *Tethyspira*. Since *Lissomyxilla hanitschi* Kirkpatrick is a reduced Myxillid and not a Clavulid, like *L. spinosa*, I propose the new genus *Myxodoryx* for its reception.

Genus ANCHINOË, Gray.

Plumohalichondria, Carter 1876, p. 236 ; *Clathrissa*, Lendenfeld 1888, p. 217.

Anchinoë latrunculioides (Ridley and Dendy).

Halichondria latrunculioides, Ridley and Dendy 1886, p. 326 ; Id. 1887, p. 6, pls. iii, xlvi : *Pyloderma latrunculioides*, Kirkpatrick 1908*β*, p. 51 : *Inflatella latrunculioides*, Hentschel 1914, p. 83 : *Clathrissa glaberrima*, Topsent 1917, p. 46, pl. ii, fig. 2, pl. vi, fig. 3 : *Pyloderma demonstrans*, Dendy 1924, p. 370, pl. ix, fig. 4, pl. xv, figs. 22–23*b*.

Occurrence.—Reg. 137, 140, stn. 331, off Cape Bird Penin., 250 faths. : Reg. 138, stn. 356, off Granite Harbour, 50 faths. : Reg. 139, 142, 143, stn. 194, off Oates Land, 180–200 faths. : Reg. 141, stn. 314, off Inaccessible Is., 222–241 faths. : Reg. 144, stn. 316, off Hut Point, McMurdo Sound, 190–250 faths.

Remarks.—Halichondria latrunculioides Ridley and Dendy is identical with *Clathrissa glaberrima* Topsent in all respects but the absence of acanthostyles and chelæ, while *Pyloderma demonstrans* Dendy lacks only the acanthostyles to make it identical with Topsent's species. The three species represent, therefore, three successive stages in the reduction of a typical *Anchinoë* by the loss of one or more categories of spicules. The nine specimens in the present collection show varying stages in this reduction, which suggests that it is not a sign of the existence of subspecies, variations or even local forms, but that we have here a species which seems capable of losing very readily one or more categories of spicules without that loss altering its shape, appearance, or method of growth in the slightest. The significance of this should not be underestimated since it is quite possible that this state of affairs is quite common and has been merely overlooked in other species, as has hitherto been the case in this one.

Inflatella belli (Kirkpatrick).

Joyeuxia belli, Kirkpatrick 1907, p. 283 ; Id. 1908*β*, p. 41, pl. xvi, figs. 1–5 : *Inflatella tubulosa*, Hentschel 1914, p. 82 : *Non Joyeuxia tubulosa*, Topsent 1904*a*, p. 206, pl. v, fig. 5, pl. xiv, fig. 16 : *Inflatella fistulosa*, Hentschel 1914, p. 83, pl. iv, fig. 8, pl. vi, fig. 8 : *Amphiastrella kirkpatricki*, Dendy 1924, p. 371, pl. ix, fig. 2 ; pl. xiv, figs. 28–31 : *Inflatella spherica*, Dendy 1924, p. 373, pl. ix, fig. 3.

Occurrence.—Reg. 291–292, stn. 340, off McMurdo Sound, 160 faths. : Reg. 293, 300–302, stn. 314, McMurdo Sound, 222–241 faths. : Reg. 294–296, stn. 316, McMurdo Sound, 190–250 faths. : Reg. 297–299, stn. 339, McMurdo Sound, 140 faths. : Reg. 303–304, stn. 294, Ross Sea, 158 faths. : Reg. 305–307, stn. 356, McMurdo Sound, 50 faths.

Remarks.—The nineteen specimens of the present collection range from 0·7 to 7 cms. in diameter. For the most part they are more or less spherical, but a few are pyriform. Several among them bear short rooting processes at the base, which are about 1 mm. in diameter and seldom exceed a length of 5 mms. The surface of the sponge may be quite smooth or may be covered with a dense pile of spicules projecting

outwards from the dermal layer. The spicules are symmetrically-ended tornota varying between 0·3 and 0·85 mm. in length, and their ends may be oxeote, strongylote or subtylostylote. Some of the specimens possess spicules which are chiefly oxeote, others chiefly strongylote, and the remainder chiefly subtylostylote, but in no case are the ends of the spicules quite constant in shape.

All the species contained in the list of synonyms given above are quite obviously identical with the same species as the "Terra Nova" specimens with the exception of *Amphiastrella kirkpatricki*. In this species, however, the external form and the shape and disposition of the spicules are so absolutely the same as those of the present examples of *Inflatella belli* that we can only regard the relation between the two species as being exactly that which exists between *Pyloderma latrunculioides* and *Clathrissa glaberrima*. In other words, *Amphiastrella kirkpatricki* is a form of *Inflatella belli* in which the full complement of spicules is present. None of the present specimens possess microscleres, but many have a quite definite, though rather diffuse, choanosomal skeleton of megascleres.

This curious species has, therefore, an affinity with the Myxilleæ. The only megascleres present are tornota which closely resemble the auxiliary spicules of the Myxilleæ, while the presence of chelæ, occasional though that may be, strengthens this view. It is feasible to suppose, therefore, that the genus *Inflatella* represents a group of specialised Myxilleæ, of peculiar external form, in which a tough cortex and a special dermal layer of spicules are developed in correlation therewith, and in which the skeleton usually undergoes a reduction involving the loss of both the microscleres and the choanosomal megascleres.

Inflatella pellicula Schmidt, the genotype, from the North Atlantic, is very closely related to the present species.

Section CRELLEÆ.

Genus CRELLA, Gray.

Grayella, Carter 1869γ, p. 190; *Yvesia*, Topsent 1890α, p. 29; *Pseudoclathria*, Dendy 1897, p. 285; *Kowalewskyella*, Swartschewsky 1905, p. 53.

Diagnosis.—Myxilleæ of varying habit in which main skeleton consists of fibres or irregular tracts of slender oxea, styli, or strongyla (? all tornota) running more or less vertically to surface; acanthostyli or acanthoxea present scattered throughout choanosome and forming a dense ectosomal layer; often (? always) there is a layer of acanthostyles at the base of the sponge whose distal ends are directed vertically; microscleres, chelæ and sigmata, one or both of which may be absent.

Remarks.—Much confusion has existed hitherto as to the validity of this and allied genera. Gray (l.c.) established the genus *Crella* for one of Schmidt's species, *Cribrella elegans*, whose generic name was preoccupied (Note.—*Cribrella* Agassiz, Echinoderms), while *Grayella* Carter (l.c.), genotype *G. cyathophora*, is clearly a synonym

of it. Topsent's (l.c.) genus *Yvesia*, genotype *Halichondria albula* Bowerbank, differs in no essential degree from the foregoing but for the presence of chelæ. Nevertheless, in the same memoir that author gives a list of species which he proposes to allocate to *Yvesia*, and of these some have chelæ, others chelæ and sigmata, others sigmata only, while the remainder have no microscleres at all. Assuming Topsent to be justified in grouping these species together, and there is no reason to think otherwise, his genus cannot be separated from *Crella*. In all probability the absence of chelæ in the genotype of the latter is purely secondary. *Halichondria compressa* Carter, the genotype of *Pseudoclathria* Dendy (l.c.), is a perfectly typical *Crella*, while *Kowalewskyella* Svarczevsky (l.c.), genotype *K. gracilis*, differs from *Crella* only in the presence of a basal layer of acanthostyles. Curiously enough, *Crella stylifera* Hentschel from the Antarctic also possesses this character, and it is highly probable that it forms a regular feature of all species of *Crella*, but that it has so far been overlooked in all but the encrusting forms.

Section TEDANIEÆ.

Tedania oxeata, Topsent.

Tedania oxeata, Topsent 1916, p. 169 ; 1917, p. 61, pl. iv, fig. 14, pl. vi, fig. 19.

Occurrence.—Reg. 71, stn. 356, McMurdo Sound, 50 faths. : Reg. 72, stn. 316, McMurdo Sound, 190–250 faths.

Genus PARATEDANIA, **gen. nov.**

Diagnosis.—Tedanieæ of symmetrical form with megascleres in form of styli or some derivative thereof, to which are added tornota, rhaphides and roughened microxea ; skeleton composed of an irregular reticulation of megascleres with tornota, rhaphides and microxea occurring between the meshes ; dermal skeleton composed of a layer of densely-packed megascleres lying parallel to surface, not more than one spicule thick.

Remarks.—The genotype, *P. tarantula* (Kirkpatrick), is somewhat similar in external appearance to the members of the genera *Histoderma*, *Phlœodictyon*, *Oceanapia*, etc., and differs from all known species of the Tedanieæ in the presence of the tangential dermal skeleton and tough, chitinoid ectosome.

Paratedania tarantula (Kirkpatrick).

Oceanapia tarantula, Kirkpatrick 1907, p. 289 ; Id. 1908β, p. 50, pl. xviii, fig. 5, pl. xxiv, fig. 8 : *Tedania actiniiformis*, Ridley and Dendy, var. *antarctica*, Hentschel 1914, p. 92, pl. iv, fig. 9, pl. vii, fig. 1 : *T. actiniiformis*, var. *amphistrongyla*, Id. l.c., p. 94, pl. vii, fig. 2 : *Oceanapia kirkpatricki*, Id. l.c., p. 125, pl. iv, fig. 13, pl. vii, fig. 10 : *Tedania charcoti*, Topsent 1917, p. 59, pl. iv, fig. 11, pl. vi, fig. 18 (*non* Topsent 1907, 1908, 1913*a*).

Occurrence.—Reg. 28–30, stn. 340, off McMurdo Sound, 160 faths. : Reg. 21–24, stn. 316, McMurdo Sound, 190–250 faths. : Reg. 25–27, stn. 355, off McMurdo Sound, 300 faths. : Reg. 31–32, stn. 194, off Oates Land, 180–200 faths.

The specimens represented by the above list of synonyms, while differing in slight details of the spiculation, have such a strong general resemblance to each other that there can be no doubt that they belong to the same species.

Perhaps the most remarkable feature of this species is the extraordinary similarity between its skeleton and that of *Tedania charcoti*, a species from which it differs entirely in external form and the nature of the ectosomal skeleton.

The present twelve specimens vary considerably in size and are pale-yellow to olive-green and dark-brown in colour. All are marked with the characteristic annulations which probably represent nothing more than growth-lines. Topsent's (1917, p. 60) view, that the curious external form may be due to the larvæ having settled in the empty chitinous tubes of some unknown animal, is improbable though not impossible. A totally different species of Desmacidonidæ from South Africa, as yet undescribed, has the same external form but was clearly attached to the substratum by rooting processes. The processes could hardly have attached themselves to the rock had the sponge been enveloped in a tube. A more probable explanation seems to be that the symmetrical form is an extreme example of the condition found in such forms as *Tedania actiniiformis*. (*Cf.* also *Tedaniopsis turbinata* Dendy.)

Section IOPHONEÆ.

Iophonopsis radiatus (Topsent).

Iophon radiatus, Topsent 1901, p. 3; 1901δ, p. 21, pl. iii, fig. 13: *I. spatulatus*, Kirkpatrick 1907, p. 276: *I. flabello-digitatus*, Id. l.c., p. 277: *I. unicornis*, Topsent 1908, p. 27, pl. v, fig. 3: *I. pluricornis*, Id. l.c., p. 29, pl. iii, fig. 5, pl. v, fig. 5: *I. radiatus*, Kirkpatrick 1908β, p. 28, pl. xxi, figs. 3, 4, pl. xxv, fig. 4: *I. spatulatus*, Id. l.c., p. 29, pl. xxi, fig. 5, pl. xxv, fig. 5: *I. flabello-digitatus*, Id. l.c., p. 30, pls. xxi, xxv, xxvi: *I. pluricornis*, Topsent 1913*a*, p. 627, pl. vi, fig. 9: *I. unicornis*, Id. l.c., p. 628, pl. iii, fig. 9: *I. spatulus*, Id. l.c., p. 628: *I. flabello-digitatus*, Id. l.c., p. 628, pl. iii, figs. 7, 8: *I. pluricornis*, var. *trullifera*, Hentschel 1914, p. 84, pl. vi, fig. 9: *I. flabello-digitatus*, Id. l.c., p. 85: *I. flabello-digitatus* var. *gaussi*, Id. l.c., p. 86, pl. vi, fig. 10: *I. spatulatus* var. *gaussi*, Id. l.c., p. 87, pl. vi, fig. 11: *I. unicornis*, Id. l.c., p. 87: *I. aceratus*, Id. l.c., p. 88, pl. vi, fig. 12: *I. proximus* var. *reticularis*, Id. l.c., p. 89: *I. pluricornis*, Topsent 1917, p. 58: *I. flabello-digitatus*, Id. l.c., p. 58, pl. iv, fig. 9.

Remarks.—No fewer than six species and four varieties of *Iophon* have been recorded from the Antarctic. In general appearance, colour and form, as well as in the general structure of the skeleton and the types of spicules present, they form a group of very closely allied organisms. The only differences worthy of notice concern: (*a*) the spining of the bases of the styli; (*b*) the shape of the bipocilla.

(*a*) The styli of *I. unicornis* have a single mucro at the base which, according to Topsent (1908, p. 28), "est équivalent au groupe d'épines que les mégasclères correspondants de *I. radiatus* portent quelquefois sur leur base." Carrying the modification still further would produce the "ganz echte Amphioxe" of *I. acerata* Hentschel

(1914, p. 89). Further, it is extremely probable that the transition between the style of *I. radiatus* with a crown of spines and the false oxeote of *I. acerata* (not a true oxeote as Hentschel suggests) may take place in a single species, if we may accept as analogy the evidence of a similar phenomenon in *Higginsia bidentifera*, whose variations I have recently investigated.

(*b*) All Antarctic species of *Iophon* have one category of anisochelæ at least, while some have a second, larger form. The smaller form common to all is practically the same in every individual so far recorded from the Antarctic, and this, together with the strong general resemblance between the various so-called species in other respects, points to the fact that they are all members of a single species in which one category of anisochelæ is always present but in which a second, larger form may occasionally be present. In this respect, there is a close parallel to *Guitarra fimbriata*.

(*c*) The bipocilla of all species of *Iophonopsis* are of such variety of form that it is not extravagant to say that the transition from the crenulate condition to that figured by Hentschel (1914, pl. vi, fig. 9) is nothing more than evidence of the normal meristic and substantive variations in the genus.

In my opinion, the Antarctic sponges hitherto referred to the genus *Iophon* are so obviously members of a single species, when examined in the light of the variations in spicule-form found in other groups of sponges, that I think it unnecessary to consider the subject in greater detail.

Family AXINELLIDÆ.

Rhizaxinella australiensis, Hentschel.

R. australiensis, Hentschel 1909, p. 397, pl. xxii, figs. 4, 5 ; text-figs. 27, 28.

Occurrence.—Reg. 202, 205, 206, stn. 194, off Oates Land, 180–200 faths. : Reg. 203, stn. 339, off McMurdo Sound, 140 faths. : Reg. 204, stn. 316, McMurdo Sound, 190–250 faths.

The eight Antarctic examples agree with the Australian forms described by Hentschel in spiculation but differ slightly in external form. On the whole the branches are much more slender. The same thing may be said of a number of forms apparently belonging to the same species sent me from South Africa.

Homaxinella supratumescens (Topsent).

Axinella supratumescens, Topsent 1907, p. 6 ; 1908, p. 32, pls. ii, iii, v ; Kirkpatrick 1908β, p. 23, pl. xxii, fig. 8, pl. xxvi, fig. 6 ; Hentschel 1914, p. 122 : *Homaxinella supratumescens*, Topsent 1917, p. 38.

Occurrence.—Reg. 200, 201, stn. 220, Robertson's Bay, 5 faths.

Family CLAVULIDÆ.

Latrunculia apicalis, Ridley and Dendy, var. *biformis*, Kirkpatrick.

L. apicalis var. *biformis*, Kirkpatrick 1908*β*, p. 14, pl. xv, figs. 1–7.

Occurrence.—Reg. 145, stn. 294, Ross Sea, 158 faths. : Reg. 146, stn. 316, McMurdo Sound, 190–250 faths. : Reg. 147, stn. 349, McMurdo Sound, 80 faths. : Reg. 148, stn. 355, Ross Sea, 300 faths.

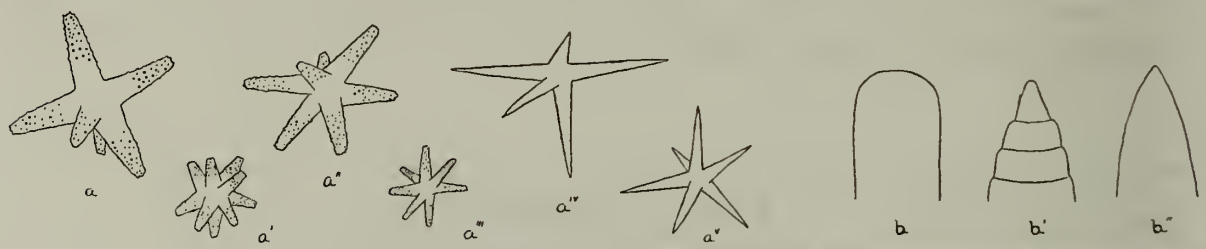
Genus HEMIASTRELLA, Carter.

Epallax, Sollas 1888, p. 423 : *Kalastrella*, Kirkpatrick 1903*a*, p. 238 : *Hemiastrella*, Topsent 1919, p. 6.

Hemiastrella digitata, **sp. n.** (Pl. IV, fig. 4, text-figure 9.)

Occurrence.—Reg. 335, stn. 339, off McMurdo Sound, 140 faths.

Diagnosis.—Sponge palmo-digitate, tough and incompressible ; surface glabrous but occasionally strongly hirsute in small patches ; neither oscules nor pores visible ; colour, in spirit, white ; skeleton composed of an axial core of megascleres from



Text-fig. 9.—*Hemiastrella digitata*, sp. n. (*a–a''*) Pseudasters, ×600 ; (*b–b''*) Various forms assumed by the bases of the megascleres.

which radial bundles are given off at right angles ; megascleres styli ; microscleres pseudasters, forming a dense surface layer and scattered throughout choanosome.

Spicules.—(1) *Styli* (Fig. 9 *b*), smooth, usually straight, variable in size, measuring on an average 1·0 by 0·022 mm. In a large number of these spicules the stylote end has become considerably modified so that the spicule ends in a series of annulations crowned by a terminal mucron. Less frequently the spicule presents the appearance of a true oxeote, but since this form is directly connected by intermediate forms with the true styli there can be no question but that they are modified styli and not true oxea. The Antarctic Desmacidonidæ seem to be particularly subject to this modification of the style (cf. *Mycale acerata*, *Acanthorhabdus fragilis*, etc.), and the present case provides strong support for the remarks concerning *Iophonopsis radiatus* (see pp. 442–3).

(2) *Pseudasters* (Fig. 9 *a*), with stout, usually truncate rays, minutely spined or tuberculate particularly towards the ends. The number of rays on a single spicule varies from 6 to 10, and the total diameter of the spicules from 0·012 to 0·027 mm.

Family SUBERITIDÆ.

Stylocordyla borealis (Lovén) var. *acuata*, Kirkpatrick.

S. borealis var. *acuata*, Kirkpatrick 1908*β*, p. 22, pl. xvi, figs. 6-10; Hentschel 1914, p. 34.

Occurrence.—Reg. 119–121, stn. 331, McMurdo Sound, 250 faths.: Reg. 122, stn. ?, off New Land, S. of Balleny Islands: Reg. 123, stn. 314, McMurdo Sound, 222–241 faths.: Reg. 124, stn. 355, off McMurdo Sound, 300 faths.: Reg. 125, stn. 356, McMurdo Sound, 50 faths.: Reg. 126–7, stn. 339, off McMurdo Sound, 140 faths.: Reg. 128, stn. 340, off McMurdo Sound, 160 faths.: Reg. 129, stn. 349, McMurdo Sound, 80 faths.: Reg. 130–133, exact locality unknown.

Suberites papillatus, Kirkpatrick.

S. caminatus var. *papillatus*, Kirkpatrick 1908*β*, p. 20, pl. xv, fig. 16, pl. xvi, figs. 11–14: *Tentorium papillatum*, Topsent 1917, p. 36, pl. iv, fig. 2.

Occurrence.—Reg. 155–158, stn. 194, off Oates Land, 180–200 faths.: Reg. 159–163, stn. 316, McMurdo Sound, 190–250 faths.: Reg. 164–166, stn. 355, Ross Sea, 300 faths.: Reg. 167–171, stn. 314, McMurdo Sound, 190–250 faths.: Reg. 172–177, stn. 356, McMurdo Sound, 50 faths.

Remarks.—Topsent (l.c.) removed this species to the genus *Tentorium*. The reason for this step appears to be the similarity in external form between the present species and *Tentorium semisuberites*. On the other hand, the skeleton of *Suberites papillatus* is that of a typical *Suberites* and is without the characteristic tangential dermal layer of megascleres of *Tentorium*.

Pseudosuberites hyalinus (Ridley and Dendy).

Hymeniacidon (?) hyalinus, Ridley and Dendy 1887, p. 168, pl. xlv, fig. 6: *Pseudosuberites hyalinus*, Topsent 1898*β*, p. 103; Id. 1900, p. 170, pl. vii, fig. 9; Id. 1913*a*, p. 26, pl. iii, fig. 10; Kirkpatrick 1908*β*, p. 21, pl. xxvi, fig. 7; Row 1911, p. 305; Hentschel 1914, p. 52: *P. hyalinus* var. *compacta*, Id. l.c., p. 53, pl. iv, fig. 1; Topsent 1917, p. 37.

Occurrence.—Reg. 62–65, 75, 76, stn. 316, McMurdo Sound, 190–250 faths.: Reg. 74, stn. 194, off Oates Land, 180–200 faths.

Remarks.—The present examples show that the supposed variety *compacta* is nothing more than a variation normal to the species.

Pseudosuberites exalbicans, Topsent.

P. exalbicans, Topsent 1913*a*, p. 614, pl. iv, fig. 5.

Occurrence.—Reg. 77, stn. 340, off McMurdo Sound, 160 faths.: Reg. 78, stn. 314, McMurdo Sound, 222–241 faths.

Remarks.—Although agreeing very closely with the holotype in external features,

the present examples contain tylostyles measuring up to 1·1 by 0·03 mm. In view of the wide range in size of the spicules of *P. hyalinus*, however, this may be regarded as nothing unusual.

Genus SUBERELLA, gen. nov

Genotype : *S. topsenti*, **nom. n.**

Holotype.—Reg. 26.10.26. 186, British Museum Coll.

Diagnosis.—Suberitidæ with specialised pore-areas ; with a single spicule form, a subtylostyle, forming a confusedly reticular skeleton in the choanosome, with a tendency to the formation of wisps or bundles of spicules, and a cortical layer of spicules, of the same size as those of the choanosome, with the apices directed towards and slightly projecting beyond the surface of the sponge.

The genus is intermediate between *Suberites* and *Pseudosuberites*.

Suberella topsenti, **nom. n.** (Pl. IV, fig. 5.)

Suberites montiniger, Topsent 1915, p. 39 ; (non *Suberites montiniger*, Carter).

Occurrence.—Reg. 186, stn. 356, McMurdo Sound, 50 faths.

Remarks.—*Suberites montiniger* Carter from the North Atlantic belongs to the genus *Pseudosuberites*, and although showing a remarkable similarity to the present species in external form, differs in the structure of its skeleton, in which a tangential dermal layer of tylostyles is the distinctive feature.

Polymastia invaginata, Kirkpatrick.

P. invaginata, Kirkpatrick 1907, p. 271; Id. 1908β, p. 15, pl. xii, fig. 1, pl. xiv, figs. 5–15: *P. invaginata* var. *gaussi*, Hentschel 1914, p. 49, pl. v, fig. 4.

Occurrence.—Reg. 104, stn. 331, McMurdo Sound, 250 faths. : Reg. 105, 160, 240, stn. 314, McMurdo Sound, 222–241 faths. : Reg. 107, stn. 356, McMurdo Sound, 250 faths.

Remarks.—The present forms are fairly typical except that Reg. 240 has no surface pile of spicules. Some, however, possess characters intermediate between those of the "Discovery" and the "Gauss" specimens, so that the retention of the var. *gaussi* seems to be no longer necessary.

Sphœrotylus antarcticus, Kirkpatrick.

S. antarcticus, Kirkpatrick 1907, p. 272 ; Id. 1908β, p. 16, pl. xii, figs. 1–16, pl. xiii, figs. 1–7 : *S. antarcticus* var. *drygalskii*, Hentschel 1914, p. 51.

Occurrence.—Reg. 96, stn. 356, McMurdo Sound, 50 faths. : Reg. 97, 99, stn. 314, McMurdo Sound. 222–241 faths. : Reg. 98, 351, stn. 331, McMurdo Sound, 250 faths.

Remarks.—Hentschel's var. *drygalskii* is founded on the difference in size between the spicules of the "Gauss" specimens and those of the "Discovery" specimens, but

in view of the variability of spicule-size in the species, such features are negligible from a taxonomic point of view, and the variety is accordingly abandoned.

Sphærotylus schœnus (Sollas).

S. capitatus var. *vanhöffeni*, Hentschel 1914, p. 50, pl. v, fig. 5.
(For further synonymy, *see* Kirkpatrick 1908*β*, p. 18, and Topsent 1923, p. 23.)

Remarks.—The use of the varietal name is here abandoned for the same reason as in the case of the preceding species.

Order EUCERATOSA.

Aplysina minima, Hentschel.

A. minima, Hentschel 1914, p. 137, pl. iv, fig. 18.

Occurrence.—Reg. 207, 353, stn. 339, off McMurdo Sound, 140 faths.

Remarks.—A small conical specimen, about 3 cms. high and 4 cms. across the base, agreeing very closely in structure and appearance with the holotype. In one respect it differs, however, in that the main fibres, the ectosome and the choanosome are crowded with a mixture of foreign spicules. In the ectosome the spicules form a very decided, densely-packed layer, while in the fibres they are arranged in a line at the centre longitudinally to the axis.

A second small macerated horny sponge (Reg. 207) may possibly belong to the same species.

Hircinia variabilis, Schulze. (Pl. IV, fig. 6.)

H. variabilis, Schulze 1879*a*, p. 12, pls. i, iii, iv.

Occurrence.—Reg. 352, stn. 339, off McMurdo Sound, 140 faths.

Remarks.—The single specimen is about 8 cms. long, 3 cms. across and 1·5 cms. high. Some $\frac{2}{3}$ths of the sponge correspond exactly in the characters of the surface with some Mediterranean sponges in the British Museum identified by Schulze as *H. variabilis*. In the remainder of the sponge, the character of the surface is very different. The surface conules are more pronounced; there are no projecting ends of the primary fibres to give a sparsely hirsute appearance; and between the conules, the surface itself shows a pronounced reticulation.

It is most improbable that the specimen represents two sponges which have grown together, yet the surface characters of its two portions are so different that, found in two separate individuals, they would lead to the two sponges being placed in different species. The probable explanation is that the two portions of the sponge grew at different seasons of the year under differing conditions of the environment.

Possibly many of the so-called species of this and other genera are no more than individuals of a single species which have achieved the maximum amount of their growth either at different seasons of the year or under different environmental conditions.

Spongelia oculata, **sp. n.** (Pl. IV, fig. 7.)

Holotype.—Reg. 26.10.26. 245, British Museum Coll.

Occurrence.—Reg. 245–247, stn. 339, off McMurdo Sound, 140 faths.

Diagnosis.—Sponge erect, branching or flabellate-digitate; surface even but slightly roughened by projecting ends of primary fibres; oscules, 1–2 mm. in diameter, arranged in linear series; colour, in spirit, pale yellow; skeleton, a reticulation of primary, secondary and, occasionally, tertiary fibres, primaries being filled with sand and foreign spicules.

Remarks.—Of the three specimens, the first, the holotype, consists of a number of cylindrical branches which show a strong tendency to anastomose. The total height of the sponge is 14 cms. and the average diameter of the branches about 1 cm. The second consists of a single branch, 14 cms. long and 1 cm. in diameter, on an average, with three small branchlets set in one plane and leaving the main branch at right angles to it. The third is flabello-digitate, about 6 cms. high and 4 cms. across at the top. In all the texture is very much that of *Spongelia fragilis* but slightly more compressible.

The skeleton consists of a reticulation of fibres composed of a clear, pale-yellow spongin, with the primaries, about 0·08 mm. in diameter, running vertically to the surface, filled with sand grains, foreign sponge spicules, foraminifera, etc. Throughout their course the primaries are connected by transverse secondary fibres, about 0·024 mm. thick, at intervals varying from 0·12 to 0·4 mm. The primaries themselves are usually about 0·5 mm. apart. Here and there the secondaries become somewhat irregular and show a tendency to break up into tertiary fibres about 0·012 mm. thick. Especially is this so at or near the surface.

The general agreement between the present specimens and the common European *Spongelia fragilis* leaves no doubt as to their generic position.

Dendrilla membranosa (Pallas).

D. antarctica, Topsent 1908, p. 11, pl. iii, fig. 2, pl. iv; Hentschel 1914, p. 137; Topsent 1917, p. 31.
(For further synonymy see Ridley 1884, p. 391.)

Occurrence.—Reg. 22, stn. 355, off McMurdo Sound, 300 faths.: Reg. 112, stn. 356, McMurdo Sound, 50 faths.

The only real difference between *D. membranosa* and *D. antarctica* lies in the colour, but since this is recognised as variable in both, no valid distinction remains between the species.

Of the present two specimens, Reg. 22 is practically identical with Ridley's specimens of *D. membranosa* and Reg. 112 with the holotype of *D. antarctica*.

V.—LIST OF WORKS REFERRED TO.

Brøndsted, H. V.—1923. Sponges from the Auckland and Campbell Islands. Vidensk. Medd. nat. For. Kjøbenhavn, LXXV, pp. 117–167.

—— 1924. Sponges from New Zealand. Vidensk. Medd. nat. For. Kjøbenhavn, LXXVII, pp. 435–483.

Burton, M.—1926. *Stelletta purpurea*, Ridley, and its variations. Ann. Mag. Nat. Hist., London, XVIII, pp. 44–49.

Carter, H. J.—1869γ. On *Grayella cyathophora*, a new genus and species of sponges. Ann. Mag. Nat. Hist., London, IV, pp. 189–197.

—— 1872. On two new sponges from the Antarctic Sea (*Tethya antarctica*, *Rossella antarctica*) and on a new species of Tethya from Shetland (*T. zetlandica*), etc. Ann. Mag. Nat. Hist., London, IX, pp. 409–419.

—— 1874. Descriptions and figures of deep-sea sponges and their spicules from the Atlantic Ocean dredged up on board H.M.S. "Porcupine," etc. Ann. Mag. Nat. Hist., London, XIV, pp. 207–221, 245–257.

—— 1876. Op. cit. pp. 226–479.

—— 1882. Some sponges from the West Indies and Acapulco, in the Liverpool Free Museum, described, with general and classificatory remarks. Ann. Mag. Nat. Hist., London, IX, pp. 266–368.

—— 1886. Descriptions of sponges from the neighbourhood of Port Philip Heads, South Australia. Ann. Mag. Nat. Hist., London, XVII, pp. 40–516.

Dendy, A.—1891. A Monograph of the Victorian Sponges. Part I. The Organisation and Classification of the Calcarea Homocœla, etc. Trans. R. Soc. Victoria, III, pp. 1–81.

—— 1895. Catalogue of Non-Calcareous sponges collected by J. Bracebridge Wilson, Esq., M.A., in the neighbourhood of Port Philip Heads. Part I. Proc. Roy Soc. Victoria, VII, pp. 232–260.

—— 1897. Catalogue of Non-Calcareous sponges collected by J. Bracebridge Wilson, Esq., M.A., in the neighbourhood of Port Philip Heads. Part III. Proc. R. Soc. Victoria, IX, pp. 230–259.

—— 1916. Report on the Non-Calcareous sponges collected by Mr. James Hornell at Okhamandal in Kattiawar in 1905–6. Rep. Government of Baroda on the Marine Zoology of Okhamandal in Kattiawar. Part II. 4to. London, pp. 93–146.

—— 1918. Calcareous Sponges. Australian Antarctic Exped. 1911–1914, Series C, VI, Part I, pp. 1–17.

—— 1921β. Report on the Sigmatotetraxonida collected by H.M.S. "Sealark" in the Indian Ocean. Trans. Linn. Soc., London, Ser. 2, Zoology, XVIII, Part I.

—— 1924. Porifera. Part I. British Antarctic ("Terra Nova") Exped. 1910. Natural History Report, Zoology, VI, 3, pp. 269–392. British Museum, London.

Dendy, A., and Row, R. W. H.—1913. The classification and phylogeny of the Calcareous sponges, with a reference list of all the described species, systematically arranged. Proc. Zool. Soc., London, pp. 704–813.

Ellis, J., and Solander, D.—1786. The Natural History of many curious and uncommon Zoophytes, etc. London, 4to. 206 pp. and 63 pl.

Fristedt, K.—1885. Bidrag till kännedomen om de vid Sveriges vestra Kust lefvande Spongiae. Akad. Handl., Stockholm, XXI, pp. 1–56.

—— 1887*a*. Sponges from the Atlantic and Arctic Oceans and the Behring Sea. ("Vega" Exped.) "Vega" Exped. Vetensk. Iakttag., Stockholm, IV, pp. 401–471.

Grant, R. E.—1833. The Lancet, I, Oct. 1833, p. 199.*

Gray, J. E.—1867. Notes on the arrangement of sponges, with the descriptions of some new genera. Proc. Zool. Soc., London, pp. 492–558.

* This work is quoted from Sherborn, Index Animalium, p. 3524.

Haeckel, E.—1869*a*. Prodromus eines Systems der Kalkschwämme. Jen. Zeitschr. V, pp. 235–254.
—— 1872. Die Kalkschwämme: eine Monographie. Vols. 1–3. Berlin.
Hentschel, E.—1909. Tetraxonida, Th. I. Die Fauna Südwest-Australiens, hrsg. v. W. Michaelsen u. R. Hartmeyer, II, 21, Jena, pp. 347–402.
—— 1914. Monaxone Kieselschwämme und Hornschwämme der deutschen Südpolar-Expedition 1901–1903. Deutsch. Südpol.-Exped., XV, Zoology, 7, pp. 35–141.
Jenkin, C. F.—1908. Calcarea. National Antarctic Exped., Natural History, IV, 3, 50 pp.
Kirkpatrick, R.—1903*a*. Descriptions of South African sponges. Part III. Marine Invest. South Africa, Dept. Agric., Cape Town, II, pp. 233–264.
—— 1905. On the oscules of Cinachyra. Ann. Mag. Nat. Hist., London, XVI, pp. 662–667.
—— 1907.—Preliminary report on the Monaxonellida of the National Antarctic Expedition. Ann. Mag. Nat. Hist., London, XX, pp. 271–291.
—— 1907*a*. Porifera, Hexactinellida. National Antarctic Exped., Natural History, III, 1, 25 pp.
—— 1908*β*. Tetraxonida. National Antarctic Exped. Natural History, IV, 2, 56 pp.
Lendenfeld, R. Von.—1888. Catalogue of sponges in the Australian Museum. Sydney. 8vo.
—— 1889. A Monograph of the Horny Sponges. 4to. London.
—— 1903. Tetraxonia. Das Tierreich. XIX. Porifera. Berlin. 8vo, 168 pp.
—— 1907. Die Tetraxonia. Wiss. Ergebn. Deutsch. Tiefsee-Exped., XI, 2, Jena, pp. 59–373.
—— 1907*a*. Tetraxonia der deutschen Südpolar-Expedition 1901–1903. Deutsch. Südpol. Exped., Berlin, IX, Zoologie, 1, pp. 303–342.
Lundbeck, W.—1905. Porifera. Part II. Desmacidonidæ (Pars.). Danish Ingolf Exped., Copenhagen, VI, 2, 219 pp.
—— 1910. Porifera. Part III. Desmacidonidæ (Pars.). Danish Ingolf Exped., Copenhagen, VI, 3, 124 pp.
Montagu, G.—1818. An Essay on Sponges, etc. Mem. Werner. Soc. II, pp. 67–122.
Noll, F. C.—1888. Beiträge zur Naturgeschichte der Kieselschwämme. *Desmacidon bosei*, Noll, mit hinweisen auf *Craniella carnosa*, Rüppell, und *Spongilla fragilis*, Leidy. Abh. Senck. Ges., Frankfurt-a.-M., XV, 2, pp. 5–58.
Poléjaeff, N. de.—1884. Calcarea. Rep. Scient. Res. Voyage H.M.S. "Challenger." London, Zoology, VIII, 76 pp.
Ridley, S. O.—1884. Spongiida (in) Report on the Zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert," 1881–2. London, 8vo, pp. 366–482, 582–630.
Ridley, S. O., and Dendy, A.—1886. Preliminary Report on the Monaxonida collected by H.M.S. "Challenger." Ann. Mag. Nat. Hist., London, XVIII, pp. 325–351, 470–493.
—— —— 1887. Monaxonida. Rep. Scient. Res. Voyage H.M.S. "Challenger," London, Zoology, XX, 59.
Row, R. W. H.—1911. Reports on the Marine Biology of the Sudanese Red Sea, from Collections made by Cyril Crossland, M.A., B.Sc., F.Z.S.—XIX. J. Linn. Soc., London, Zoology, XXXI, pp. 287–400.
Schmidt, O.—1880. Die Spongien des Meerbusen von Mexico und des Caraibischen Meeres. Heft II. Jena.
Schulze, F. E.—1879*a*. Untersuchungen über den Bau und die Entwicklung der Spongien. Zeitschr. wiss. Zool. Leipzig, XXXIII, pp. 1–38.
—— 1880. Untersuchungen über den Bau und die Entwicklung der Spongien. IX. Die Plakiniden. Zeitschr. wiss. Zool., Leipzig, XXXIV, pp. 407–451.
Schulze, F. E., and Kirkpatrick, R.—1910. Preliminary notice of the Hexactinellida of the "Gauss" Expedition. Zool. Anz., XXXV, pp. 293–302.
—— —— 1910*a*. Die Hexactinelliden der Deutschen Südpolar-Expedition, 1901–1903. Deutsche Südpol.-Exped., Berlin, XII, Zoologie 4, 62 pp.
Sollas, W. J.—1886. Preliminary account of the Tetractinellid Sponges dredged by H.M.S. "Challenger," 1872–76. Part I. The Choristida. Dublin Soc. Proc., V, pp. 177–199.
—— 1888. Report on the Tetractinellida collected by H.M.S. "Challenger" during the years 1873–6. Rep. Scient. Res. Voyage H.M.S. "Challenger," London, Zoology, XXV.
Stephens, J.—1915. Sponges of the Coast of Ireland. I. The Triaxonida and part of the Tetraxonida. Dublin, Fish. Ireland, Sci. Invest., IV, 43 pp.

Stephens, J.—1921. Sponges of the Coasts of Ireland. II. The Tetraxonida (*concluded*). Fisheries, Ireland, Sci. Invest., London, II, 75 pp.

Swartschewsky, B.—1905. Beitrag zur Kenntniss der Schwamm-Fauna des Schwarzen Meeres. Mém. Soc. Natural, Kiew, XX, pp. 1–59.

Thiele, J.—1905. Die Kiesel- und Hornschwämme der Sammlung Plate. Zool. Jahrb., Jena, Suppl. VI, (Fauna Chilensis) pp. 407–496.

Topsent, E.—1890*a*. Notice préliminaire sur les Spongiaires recueillis durant les campagnes de l'Hirondelle. Bull. Soc. Zool. France, XV, pp. 26–71.

—— 1892. Contribution à l'étude des Spongiaires de l'Atlantique Nord. Résultats des Campagnes scientifiques accomplies sur son yacht par Albert I, Prince Souverain de Monaco, publiés sous sa direction, avec le concours du Baron Jul. de Guerne. Fasc. II. Monaco, 4to, 165 pp.

—— 1892*a*. Diagnoses d'éponges nouvelles de la Méditerranée et plus particulièrement de Banyuls. Arch. Zool. exp., Paris, X, pp. xvii–xxviii.

—— 1898*β*. Introduction à l'étude monographique des Monaxonides de France. Classification des Hadromerina. Arch. Zool. expér., Paris, VI, pp. 91–113.

—— 1900. Étude monographique des Spongiaires de France. III. Monaxonida (Hadromerina). Arch. Zool. expér., Paris, VIII, pp. 1–331.

—— 1901. Notice préliminaire sur les éponges receuillies par l'expedition antarctique belge. Arch. Zool. expér., Paris, IX, pp. v–xvi.

—— 1901*δ*. Spongiaires. Résult. Voyage Belgica Zool., Anvers, 4to, 54 pp.

—— 1904*a*. Spongiaires des Açores. Résult. Camp. Scient. Albert de Monaco, Fasc. XXV, 280 pp.

—— 1907. Poecilosclérides nouvelles receuillies par le Français dans l'Antarctique. Bull. Mus. Hist. nat., Paris, pp. 69–76.

—— 1907*β*. Éponges calcaires receuillies par le Français dans l'Antarctique (Expédition du Dr. Charcot). Bull. Mus. Hist. nat., Paris, pp. 539–544.

—— 1908. Spongiaires. Expédition antarctique française (1903–5) (Expédition Charcot). Paris, 4to, 37 pp.

—— 1910. Les Hexasterophora receuillies par la Scotia dans l'Antarctique. (Note préliminaire). Bull. Inst. océan., Monaco, 166, 18 pp.

—— 1913*a*. Spongiaires de l'expédition antarctique nationale écossaise. Trans. Roy. Soc., Edinburgh, XLIX, 3, 9, pp. 579–643.

—— 1915. Spongiaires receuillies par la " Scotia " dans l'Antarctique (1903–4). Supplement. Trans. Roy. Soc., Edinburgh, LI, pp. 35–43.

—— 1916. Diagnoses d'éponges receuillies dans l'Antarctique par le Pourquoi Pas ? Bull. Mus. Hist. nat., Paris, pp. 1–10.

—— 1917. Spongiaires (in) Deuxième expédition antarctique française (1908–1910) commandée par le Dr. Jean Charcot. Sciences Physiques : Documents Scientifiques. Paris, 4to, 88 pp.

—— 1919. Notes sur les genres *Semisuberites* et *Hemiasterella*. Bull. Inst. océan., Monaco, 359, 11 pp.

—— 1924*β*. Révision des Mycale de l'Europe Occidentale. Ann. Inst. océan., Monaco, I, 3, pp. 77–118.

Urban, F.—1909. Die Calcarea. Wiss. Ergeb. der deutsch. Tiefsee-Exped. (" Valdivia "), Jena, 4to, XIX, pp. 1–40.

Vosmaer, G. C. J.—1880. Sponges of the Leyden Museum. I, The family of the Desmacidinæ. Notes Leyden Museum, II, pp. 99–164.

Wilson, H. V.—1904. The Sponges. In : Reports on an Exploration off the West Coasts of America, etc. Mem. Mus. Comp. Zool. Harvard Coll., XXX, No. I, 164 pp. and 26 pl.

INDEX.

[The more important references are given in black type.]

Acanthorhabdus, **432.**
acerata, Mycale, 430, **444.**
,, var. minor, Mycale, 430.
aceratus, Iophon, 442.
Achramorpha, 402.
actiniiformis, Tedania, 442.
,, var. amphistrongyla, Tedania, 441.
,, var. antarctica, Tedania, 441.
acuata, Stylocordyla borealis, subsp., **445.**
alba, Tetilla grandis var., 418.
albula, Halichondria, **441.**
altera, Chalina, **420.**
,, Reniera, 420.
Amphilectus, **428.**
amphistrongyla, Tedania actiniiformis, var., 441.
Anaulosoma, **404.**
Anchinoë, 439.
Anoxycalyx, 413.
antarctica, Anchinoë toxiferum, subsp., 434.
,, Cinachyra, **419.**
,, Dendrilla, 448.
,, Guitarra, 426.
,, Leucetta, 404.
,, Plakina monolopha, subsp., **414.**
,, ,, trilopha, subsp., **414.**
,, Rossella antarctica, subsp., **405,** 407.
,, Rossella, **404,** 409.
,, Tedania actiniiformis, var., 441.
,, Tethya, 419.
,, Tetilla, 419.
,, subsp. antarctica, Rossella, **405,** 407.
,, subsp. gaussi, Rossella, 405.
,, subsp. solida, Rossella, 405.
,, var. novæ-zealandiæ, Guitarra, 426.
antarcticus, Sphærotylus, 446.
,, var. drygalskii, Sphærotylus, 446.
aperta, Aulorosella, 409.
apicalis, var. biformis, Latrunculia, **444.**
apollinis, Amphilectus, 431.
,, Artemisina, 431.
Aplysina, 447.
arenosa, Desmacidon, 425.
,, Plumocolumella, 425.
armata, Aulorossella vanhöffeni, 409.
Artemisina, 431.
Aulorossella, **404.**
auroræ, Grantia cirrata, var., 402.
australiensis, Rhizaxinella, **443.**
australis, Rhabdocalyptus, 405, 407.
Axinellidæ, **443.**
Axociella, 433.

barbata, Cinachyra, 418, **419.**
belli, Inflatella, 430, **439.**
,, Joyeuxia, 439.
benedeni, Gelliodes, **423.**
,, var. fortior, Gelliodes, 423.
,, Gellius, 423.
bidens, Gellius, **423.**
bidentifera, Higginsia, 443.
biformis, Myriastra, 415.
bipocillifera, Guitarra, 426.
bistellata, Stelletta maori, var., 414.
borealis, subsp. acuata, Stylocordyla, **445.**
bosei, Desmacidon, 429.
botryoides, Leucosolenia, 401.
,, Spongia, 401.
botrys, Ascandra, 401.
brondstedi, Monosyringa, **415.**
Brondstedia, **428.**
brumalis, Leucandra, 403.

cactoides, Isodictya, **424.**
Calcarea, 401.
Calyx, **422.**
caminatus, var. papillatus, Suberites, 445.
capitatus, var. vanhöffeni, Sphærotylus, 447.
carnosa, Plumocolumella, 425.

carnosa, Fibulia, 424, 425.
cavicornuta, Isodictya, **424.**
ceratosus, Chondropsis, 433.
Cercidochela, **424.**
Chalina, **419.**
chaliniformis, Chondropsis, **433.**
,, Phoriospongia, 433.
,, Plumocolumella, 425.
,, Dysidea, 425, 433.
charcoti, Microxina, **423.**
,, Tedania, 441.
chartacea, Grantia, 402.
chartaceum, Dermatreton, 402.
Chondrocladia, 431.
Chondropsis, 433.
Cinachyra, 419.
cinerea, Reniera, 419.
,, var. porosa, Reniera, 419.
cirrata, Grantia, 402.
,, var. auroræ, Grantia, 402.
,, Leucandra, 402.
Cladochalina, **421.**
Clathriæ, 433.
Clathrissa, 439.
clavata, Chondrocladia, **431.**
Clavulidæ, 444.
coactifera, Tethya, 418.
compacta, Petrosia similis var., 421.
,, Pseudosuberites hyalinus, var., 445.
complicata, Spongia, 402
compressa, Halichondria, **441.**
conulissima, Desmacidon, 425.
,, Plumocolumella, 425.
coralloides, Rhabderemia, **435.**
coriacea, Leucosolenia, 402.
,, Spongia, 402.
Corybas, **428.**
cranium, Craniella, 418.
crater, Stelletta, **415.**
Crella, **440.**
Crelleæ, 440.
Crellomyxilla, 437.
Cribrella, **440.**
cribricutis, Reniera, 421.
cribriporosa, Plumocolumella, **425.**
crispatus, Megapogon, 403.
cyathophora, Grayella, **440.**
cylindrica, Reniera, 420.

dancoi, Chalina, **420.**
,, Reniera, 420.
decora, Esperiopsis, 429, 437.
demonstrans, Pyloderma, 439.
Dendoryx, 435.
Dendrilla, 448.
dendyi, Cladochalina, **421.**
depellens, Pellina, 421.
,, Petrosia, 421.
Desmacella, 431.
Desmacidon, **423.**
dianæ, Artemisina, 431.
digitata, Hemiastrella, 444.
discoveryi, Leucosolenia, 401.
drygalskii, Sphærotylus antarcticus, var., 446.
dujardini, var. magellanica, Halisarca, **414.**
dura, Petrosia, 420.

Ectyomyxilla, 437.
edwardii, Esperiopsis, 430.
elegans, Cribrella, **440.**
elongata, Myxilla, **435.**
Emplocus, 435.
Epallax, 444.
Esperiopsis, **428.**
Euceratosa, 447.
eurasia, Plakina monolopha, subsp., **414.**
exalbicans, Pseudosuberites, 445.

fibulata, Rossella, 407.
fimbriata, Guitarra, 443, **426.**
fimbriatus, Gellius, 422.
fistulata, Petrosia, 420.
fistulosa, Inflatella, 439.
flabellata, Axociella, **433.**
,, Lissodendoryx, **436.**
,, Ophlitaspongia, 433.
flabelliformis, var., Gellius, 423.
flabello-digitatus, Iophon, 442.
,, ,, var. gaussi, Iophon, 442.
flaccida, Reniera, 420.
flagellum, Esperiopsis, 429.
fortior, Gelliodes benedeni, var., 423.
fragilis, Acanthorhabdus, **432,** 444.
,, Spongelia, 448.
frigida, Leucandra, 403.
,, Leuconia, 403.
fruticosa, Desmacidon, **424.**
,, Spongia, 424.
fucorum, Isodictya, 428.

gaini, Aulorossella, 409.
gaussi, Iophon flabello-digitatus var., 442.
,, ,, spatulatus var., 442.
,, Polymastia invaginata var., 446.
,, Rossella, 407.
,, Rossella antarctica subsp., 405.

gelatinosa, Leucandra, 403.
Gelliodes, **423**, 433.
Gellius, **422.**
Geodiidæ, 417.
Geodinella, 417.
glaber, Esperiopsis, **428.**
glaberrima, Clathrissa, 439.
gracilis, Isodictya, 428.
,, Kowalewskyella, **441.**
grandis, Tethya, 418.
,, Tetilla, 418.
,, grandis, Tetilla, 418.
,, var. alba, Tetilla, 418.
Grantia, 402.
Grantiidæ, 402.
Grayella, **440.**
Guitarra, 426.
Guitarreæ, 426.
Gymnorossella, 413.

Halichondria, 421, **441.**
Halisarca, 414.
hanitschi, Lissomyxilla, 438.
Haploscleridæ, 419.
Hastatus, 435.
Hemiastrella, **444.**
hentscheli, Ectyomyxilla, **437**
Hexactinellida, 401.
hexactinophila, Rossella, 407.
Higginsia, 443.
Hircinia, 447.
hirsuta, Leucandra, 402.
,, Grantia, 402.
hispida, Desmacidon, 425.
,, Plumocolumella, 425.
Histoderma, 441.
hodgsoni, Dermatreton, 402.
,, Grantia, 402.
,, Hyalascus, 409.
Homaxinella, 443.
Homocœlidæ, 401.
Homosclerophora, 414.
hyalinus, Hymeniacidon, 445.
,, Pseudosuberites, **445.**
,, var. compacta, Pseudosuberites, 445.
Hymedesmia, **434.**
Hymedesmieæ, 434.
Hymenancora, **434.**

ijimai, Anoxycalyx, **413.**
incerta, Leucosolenia, 401.
incognita, Esperiopsis, 429.
indica, Guitarra, 426.
inermis, Gymnorossella, **413.**
Inflatella, 439.
innominata, Lissodendoryx, 436.
intermedia, Crellomyxilla, 437.
,, Desmacidon, 425.
,, Plumocolumella, 425.
invaginata, Polymastia, 419, **446.**
invaginata var. gaussi, Polymastia, 446.
Iophoneæ, 442.
Iophonopsis, 442.
Isodictya, **423.**
Isodictyeæ, **423.**

Jaspis, 415.
joubini, Leucandra, 403.
,, Leuconia, 403.
,, Scolymastra, **413.**

Kalastrella, 444.
kerguelensis, var. cactoides, Desmacidon, 424.
,, Ectyomyxilla, **437.**
,, Reniera, 419.
kirkpatricki, Amphiastrella, 439.
,, Homœodictya, 424.
,, Isodictya, **424.**
,, Oceanapia, 441.
Kowalewskyella, 440, **441.**

lamarckii, Leucosolenia, 402.
lancifer, Leucettusa, 402.
lankesteri, Cercidochela, **426.**
Latrunculia, 444.
latrunculioides, Anchinoë, **439.**
,, Halichondria, 439.
,, Inflatella, 439.
,, Pyloderma, 439.
leptoderma, Craniella, 418.
,, Tetilla, **418.**
leptorhaphis, Leucandra primigenia, var., 404.
,, Leucetta, **404.**
Leptosia, **434.**
Leucaltidæ, 402.
Leucandra, 403.
Leucascidæ, 404.
Leucetta, 404.
Leuconia, 403.
levis, Aulorossella, 409.
,, Leuconia, 403.

lipochela, Artemisina plumosa, var., 431.
Lissodendoryx, 436.
Lissomyxilla, 438.
lobata, Isodictya, 428.
,, Spongia, **428.**
longispinum, Monosyringa, 416, 417.
,, Tribrachion, 416, 417.
longstaffi, Aulorossella, 409.
lucasi, Leucosolenia, 401.
lynchnophora, Rossella, 407.

macquariensis, Leucetta, 403.
macrosigma, Esperiopsis, 429.
,, var. novæ-zealandiæ, Esperiopsis, 429.
mæandrina, Desmacidon, 425.
,, Plumocolumella, 425.
magellanica, Halisarca dujardini, var., **414.**
major, Amphilectus rugosa, var., **430.**
,, Esperiopsis rugosa, var., 430.
maori, Stelletta, **414.**
,, var. bistellata, Stelletta, 414.
massa, Petrosia similis, var., 421.
mawsoni, Leucandra, 403.
megachela, Esperiopsis, 429.
,, raripilis, 403.
membranosa, Dendrilla, **448.**
mercator, Suberotelites, 434.
metaclada, Tethyopsilla, 418.
,, Tetilla, 418.
microdiscina, Rossella racovitzæ, 407.
microsigma, craniella sagitta, var., 418.
Microxina, **423.**
minchini, Leucosolenia, 401.
minima, Aplysina, **447.**
minor, Mycale acerata var., 430.
minuta, Rossella racovitzæ, 407.
mixta, Rossella, 407.
monolopha, Plakina, **414.**
,, subsp., antarctica, Plakina, **414.**
,, ,, eurasia, Plakina, **414.**
Monosyringa, 415, 416.
montiniger, Suberites, 446.
mortenseni, Monosyringa, 417.
Mycale, 430.
Mycaleæ, 428.
Myxilla, **435.**
Myxodoryx, **438.**
Myxospongida, 414.

nidificata, Axociella, **433.**
,, Ophlitaspongia, 433.
nivea, Spongia, 403.
novæ-zealandiæ, Chalina oculata, var., 421.
,, ,, Desmacidon, 425.
,, ,, Esperiopsis macrosigma, var., 429.
,, ,, Guitarra antarctica, var., 426.
,, ,, Jaspis, **415.**
,, ,, Plumocolumella, 425.
nuda, Rossella, 405, **409.**

Oceanapia, 441.
oculata, Chalina, 419, 421.
,, var. novæ-zealandiæ, Chalina, 421.
,, Spongelia, **448.**
oxeata, Tedania, **441.**

pachyrrhabdus, Craniella sagitta, var., 418.
panicea, Halichondria, **421.**
papillatum, Tentorium, 445.
papillatus, Suberites, **445.**
,, ,, caminatus, var., 445.
Paratedania, **441.**
pellita, Mycale, **430.**
Penares, 415.
penicillata, Chalina, **420.**
,, Reniera, 420.
phakellioides, Sigmaxynissa, 423.
,, Gellius, **423.**
Phlœodictyon, 441.
pilosa, Aulorossella, 409.
,, Gellius, 422.
Plakina, 414.
Plakinidæ, 414.
Plocamiæ, 435.
Plumohalichondria, 439.
Plumocolumella, **424.**
plumosa, Artemisina, **431.**
,, var. lipochela, Artemisina, 431.
pluricornis, Iophon, 442.
,, var. trullifera, Iophon, 442.
podagrosa, Rossella, 407.
,, tenuis, Rossella, 407.
pollicaris, Megapogon, 403.
Polymastia, 446.
porosa, Reniera cinerea, var., 419.
primigenia, var. leptorhaphis, Leucandra, 404.
primordialis, Prosycum, 402.
prœdita, Esperiopsis, 429.
proximus var. reticularis, Iophon, 442.
Pseudanchinoë, 433.
Pseudoclathria, 440, **441.**
Pseudosuberites, 445, 446.
purpurea, Stelletta, **415.**

racovitzæ, Rossella, 405, **407**, 412.
,, microdiscina, Rossella, 407.
,, minuta, Rossella, 407.
,, racovitzæ, Rossella, 407.
radiatus, Iophon, 442.
,, Iophonopsis, **442**, 444.
ramosa, Desmacidon, 425.
,, Plumocolumella, 425.
raripilis, Megapogon, 403.
Reniera, **419.**
reticularis, Iophon proximus var., 442.
retiderma, Halichondria, 421.
Rhabderemia, 435.
Rhizaxinella, 443.
Rossella, **404,** 405.
Rossellidæ, 404.
rudis, Gellius, **422.**
rugosa, var. major, Amphilectus, **430.**
,, ,, ,, Esperiopsis, 430.

sagitta, Tethya, 418.
,, var. microsigma, Craniella, 418.
,, ,, pachyrrhabdus, Craniella, 418.
sandalinum, Stelletta, 414.
schmidtii, Tribrachium, 417.
schœnus, Sphærotylus, 447.
schulzii, Anaulosoma, 409.
Scolymastra, 413.
scotti, Grantia, 402.
,, Renicra, 420.
,, Tenthrenodes, 402.
semisuberites, Tentorium, 445.
sigmatifera, Guitarra, 426.
Sigmatosclerpohora, 418.
similis, Petrosia, 421.
,, var. compacta, Petrosia, 421.
,, ,, massa, Petrosia, 421.
spatulatus, Iophon, 442.
,, var., gaussi, Iophon, 422.
Sphærotylus, 446.
spherica, Inflatella, 439.
spinigera, Desmacidon, 424.
,, Isodictya, **424.**
spinosa, Lissomyxilla, 438.
Spongelia, 448.
spongiosa, Myxilla, 438.
spongiosus, Gelliodes, 423
Stelletta, 414.
Stellettidæ, 414.
stipitatus, Calyx, 422.
strongyla, Artemisina, 431.
Strongylacidon, **423.**
stylifera, Crella, 441.
stylifera, Tethya, 418.
Stylocordyla, 445.
Stylopus, **434.**
Suberella, **446.**
Suberites, 445.
Suberitidæ, 445.
Suberotelites, **434.**
supratumescens, Axinella, 443.
,, Homaxinella, **443.**

tabernacula, Reniera, 421.
tarantula, Oceanapia, 441.
,, Paratedania, **441.**
Tedania, 441.
Tedaniæ, 441.
tenellus, Gellius, 422.
tenuis, Grantia, 402.
,, Rossella podagrosa, 407.
Tereus, 435.
Tethyspira, 438.
Tetilla, 418.
Tetillidæ, 418.
Tetraxonida, 414.
topsenti, Chalina, **419.**
,, Reniera, 419.
,, Suberella, **446.**
tornotata, Myxilla, 437.
toxiferum, Pseudanchinoë, **434.**
,, subsp. antarctica, Anchinoë, 434.
,, Stylostichon, **433,** 434.
Trachyopsis, 422.
tridens, Mycale, 430.
trilopha, Plakina, **414.**
,, subsp. antarctica, Plakina, **414.**
trullifera, Iophon pluricornis, var., 442.
truncata, Achramorpha, 402.
,, Grantia, 402.
,, Petrosia, 421.
tubulosa, Inflatella, 439.
,, Joyeuxia, 439.
turbinata, Tedaniopsis, 442.
tylotaster, Penares, **415.**

unguifera, Hymedesmia, **434.**
unicornis, Iophon, 442.

vanhöffeni armata, Aulorossella, 409.
,, vanhöffeni, Aulorossella, 409.
,, Sphærotylus capitatus, var., 447.
variabilis Halichondria, **421.**

variabilis, Hircinia, 447.
„ Leucosolenia, 401.
„ Petrosia, 421.
„ Schmidtia, 421.
verrucosa, Homœdictya, 424.
„ Isodictya, 424.
vertex, Cinachyra, 419.
vestibularis, Desmacella, **431.**
„ Tylodesma, 431.
vestigifera, Geodinella, **417.**
villosa, Esperia, 429.
„ Esperiopsis, 428, **429**, 437.
„ Rossella, 405, **412.**
villosus, Megapogon, 403.
virens, Chalina, **420.**
„ Reniera, 420.
voluta, Guitarra, 426.

Yvesia, **440.**

BRITISH MUSEUM NATURAL HISTORY Z D

27 MAY 1929. PRESENTED

PRINTED IN GREAT BRITAIN BY WILLIAM CLOWES AND SONS, LIMITED, LONDON AND BECCLES.

Porifera, Part II.—Antarctic Sponges, Pl. I.

PLATE I.

Rossella racovitzæ, showing the rapid proliferation of buds which occasionally takes place. About natural size.

F.Hedgeock, phot. et del. Hedgeock imp.

Brit. Mus. (Nat. Hist.)

BRITISH MUSEUM
NATURAL HISTORY
Z D

PLATE II.

Rossella nuda, × 1/2.

P. Highley phot. et. C. Hodges imp.

Sponges. Pl. II.

BRITISH MUSEUM
Z D
NATURAL HISTORY

PLATE III.

Rossella villosa, × 1/2.

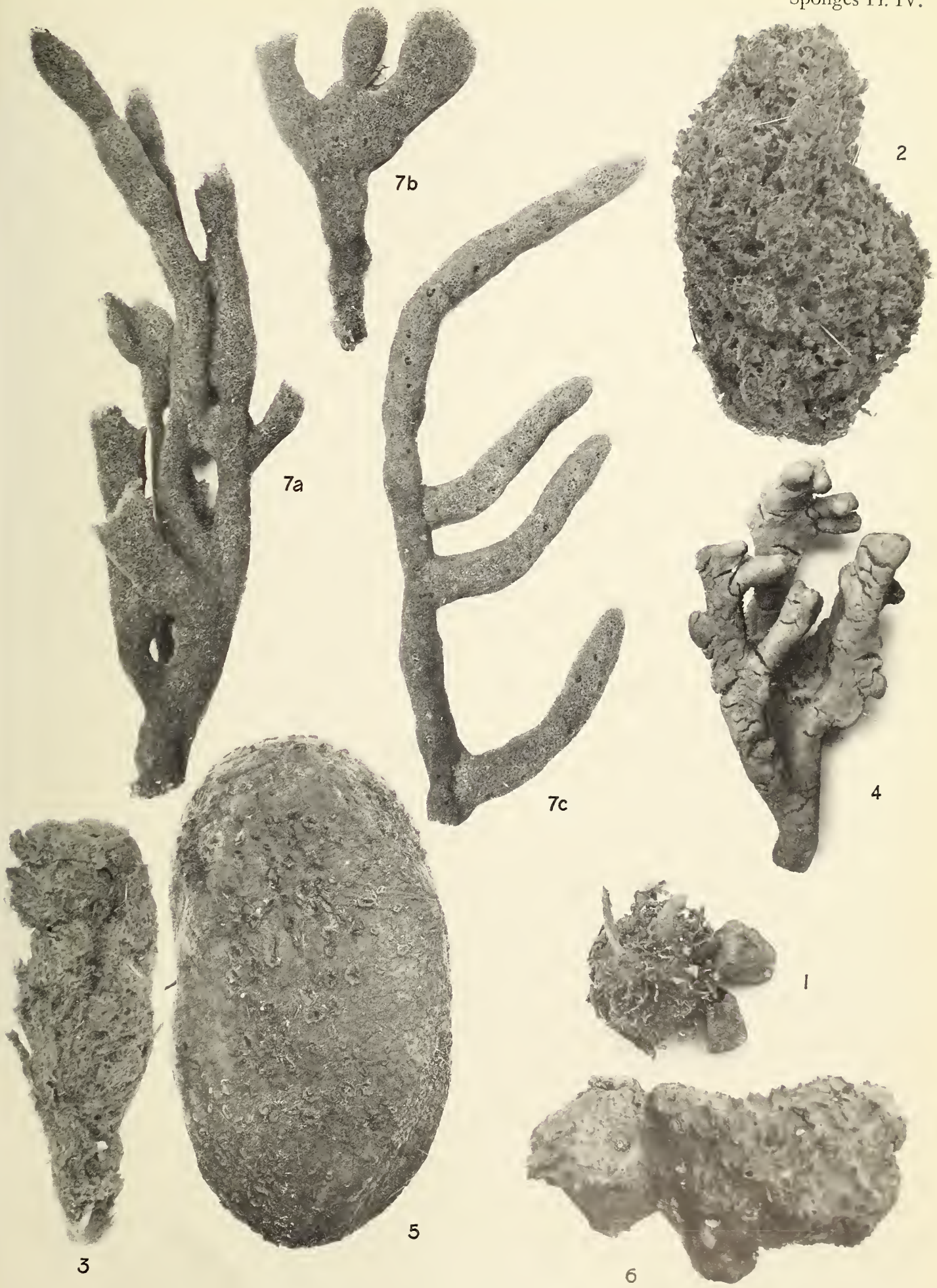
Sponges Pl. III

F. Hughley phot. et C. Hodges imp.

BRITISH MUSEUM
NATURAL HISTORY
Z D

PLATE IV.

FIG. 1.—*Monosyringa brondstedi*, sp. n., × 1/1.
,, 2.—*Acanthorhabdus fragilis*, sp. n., × 2/3.
,, 3.—*Lissodendoryx flabellata*, sp. n., × 1/1.
,, 4.—*Hemiasterella digitata*, sp. n., × 1/1.
,, 5.—*Suberella topsenti*, sp. n., × 1/1.
,, 6.—*Hircinia variabilis*, Schulze, × 1/1.
,, 7 *a–c.*—*Spongelia oculata*, sp. n., × 1/1.


7b
2
7a
7c
4
1
3
5
6

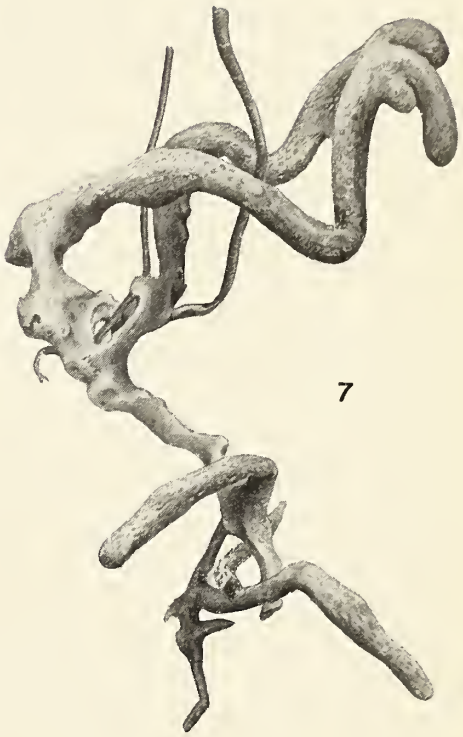
BRITISH MUSEUM
Z D
NATURAL HISTORY

PLATE V.

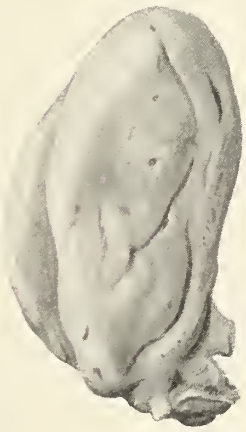
FIGS. 1–4.—*Leuconia leptorhaphis* (Jenkin), × 3/4.
„ 5, 6.—*Calyx stipitatus*, Topsent, × 1/3 ; 5, flabellate form ; 6, branching form.
„ 7.—*Plumocolumella cribriporosa*, sp. n., × 1/2.
„ 8.—*Cercidochela lankesteri*, sp. n., × 1/2.

5

3



7



2

6

1

4

8

BRITISH MUSEUM
Z D
NATURAL HISTORY